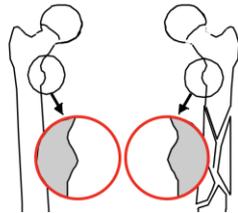
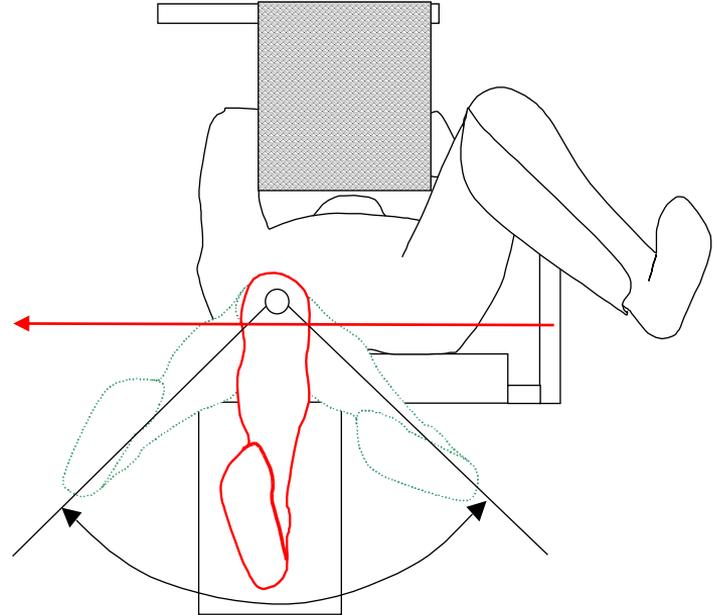
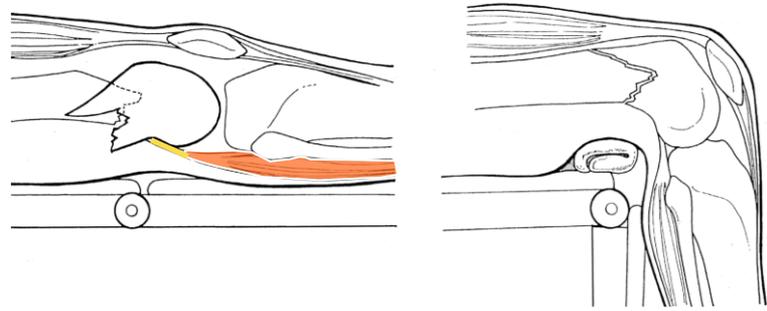


Distal Femur Fractures – Tips for Success

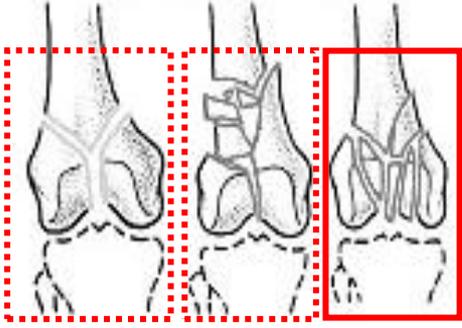


Preparation

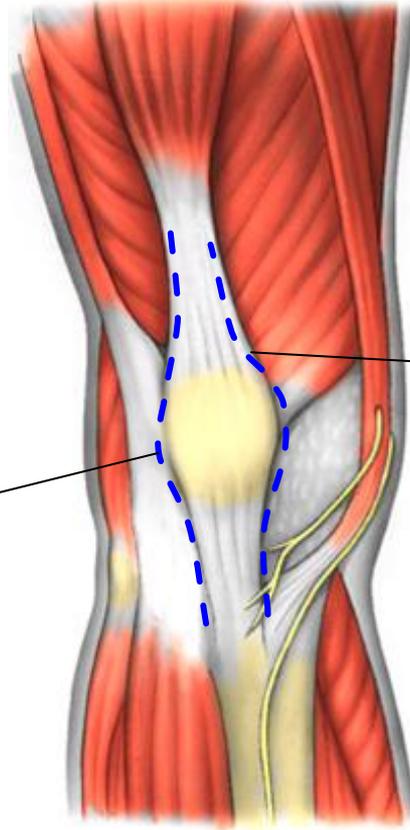
- supine, radiolucent table
- Knee flexion / bolster
- good C-Arm, large field, 2 monitors
- get contralateral leg out of C-arm beam
 - Obstetric leg holder or
 - elevate ipsilateral leg & lower contralateral side & rotate table
- Entire leg draped
- No tourniquet
- check contra-lateral side length / ROM Hip joint
 - hyperextension test
 - lesser troch shape



Approach



1. lateral parapatellar
C1-C3 Type
lateral B2 (Hoffa)



2. medial parapatellar
medial B2 Type (Hoffa)

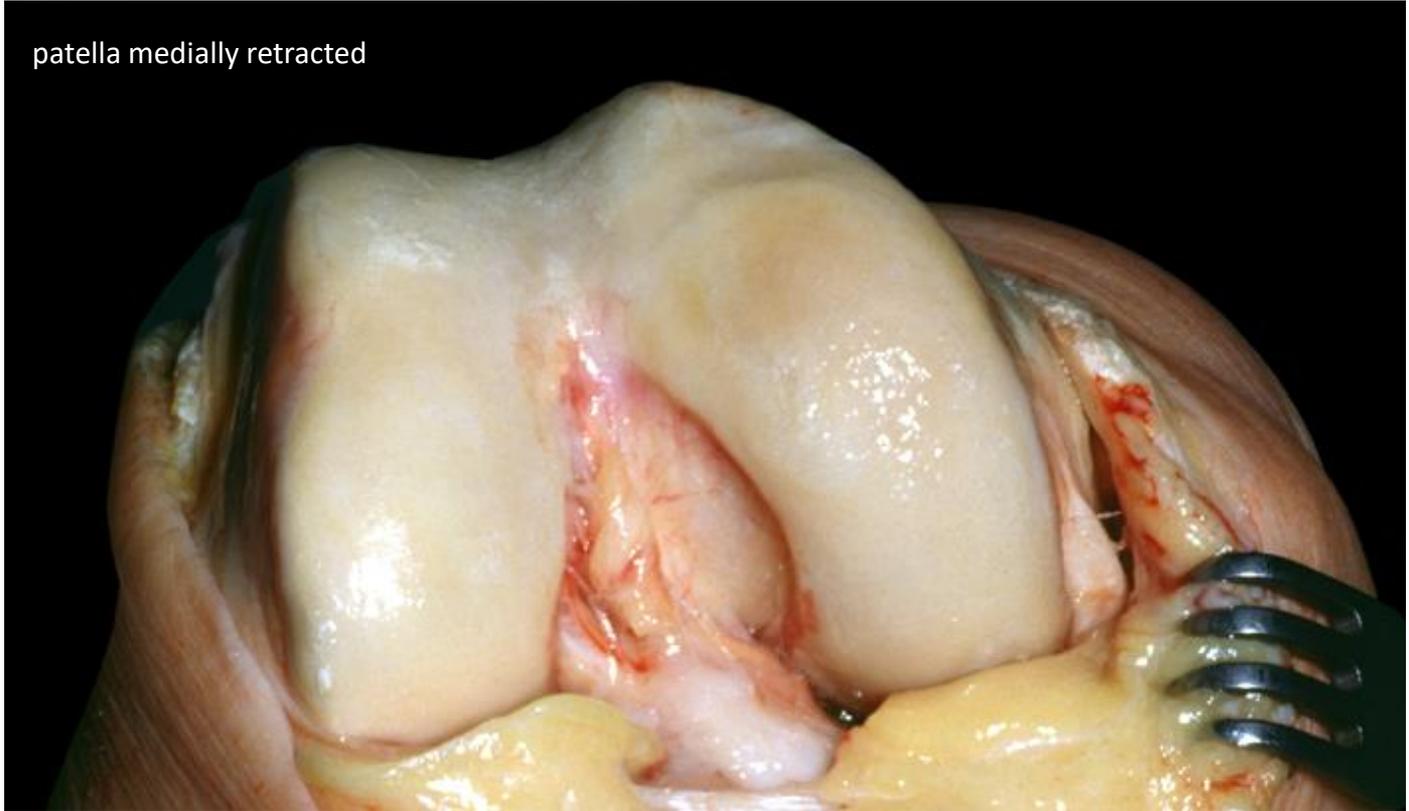
TARPO

Transarticular Approach & Retrograde Plate-Osteosynthesis

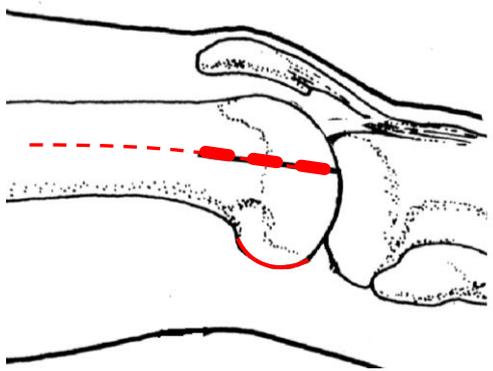
Krettek, Miclau, Tscherne et al (1997) Injury 28:31

keystep:
lateral
parapatellar
arthrotomy

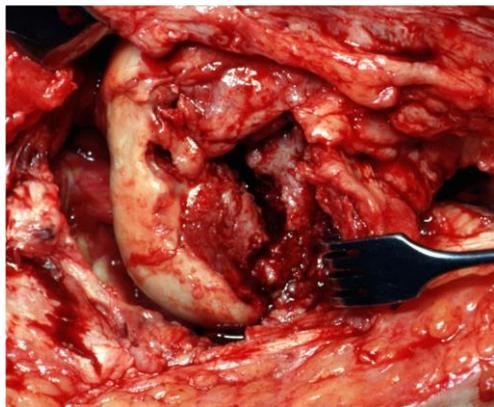
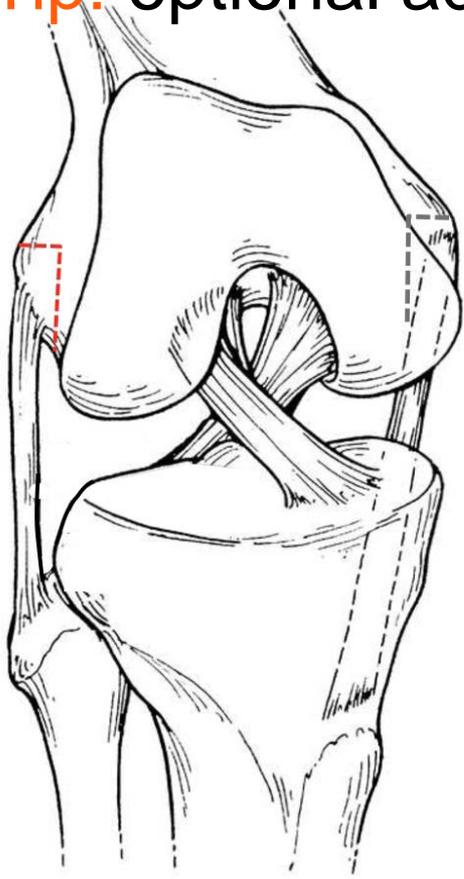
patella medially retracted



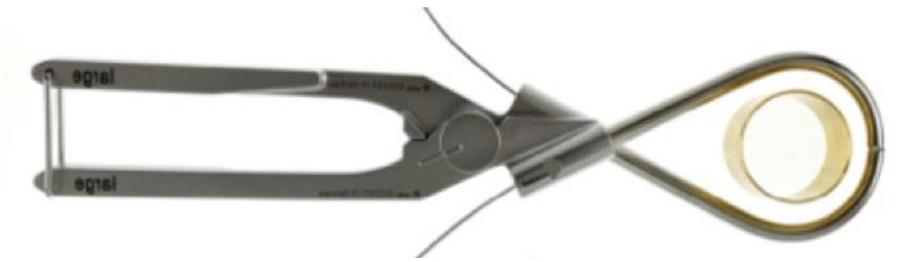
2. Direct Lateral Approach (A-types, undisplaced C1 Fx)



Tip: optional additional epicondyle OT (B type fx)



reduction aids

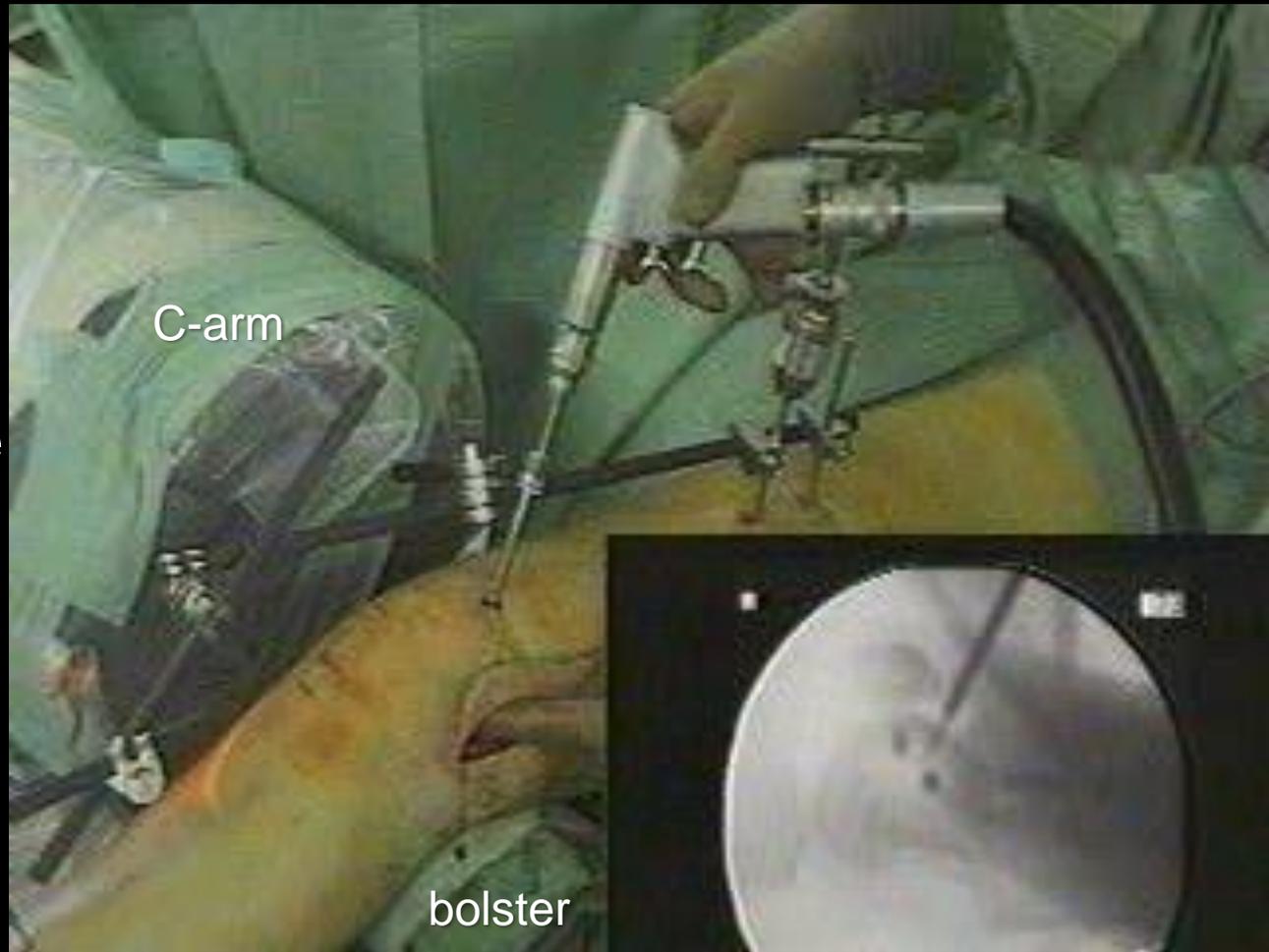


ExFix

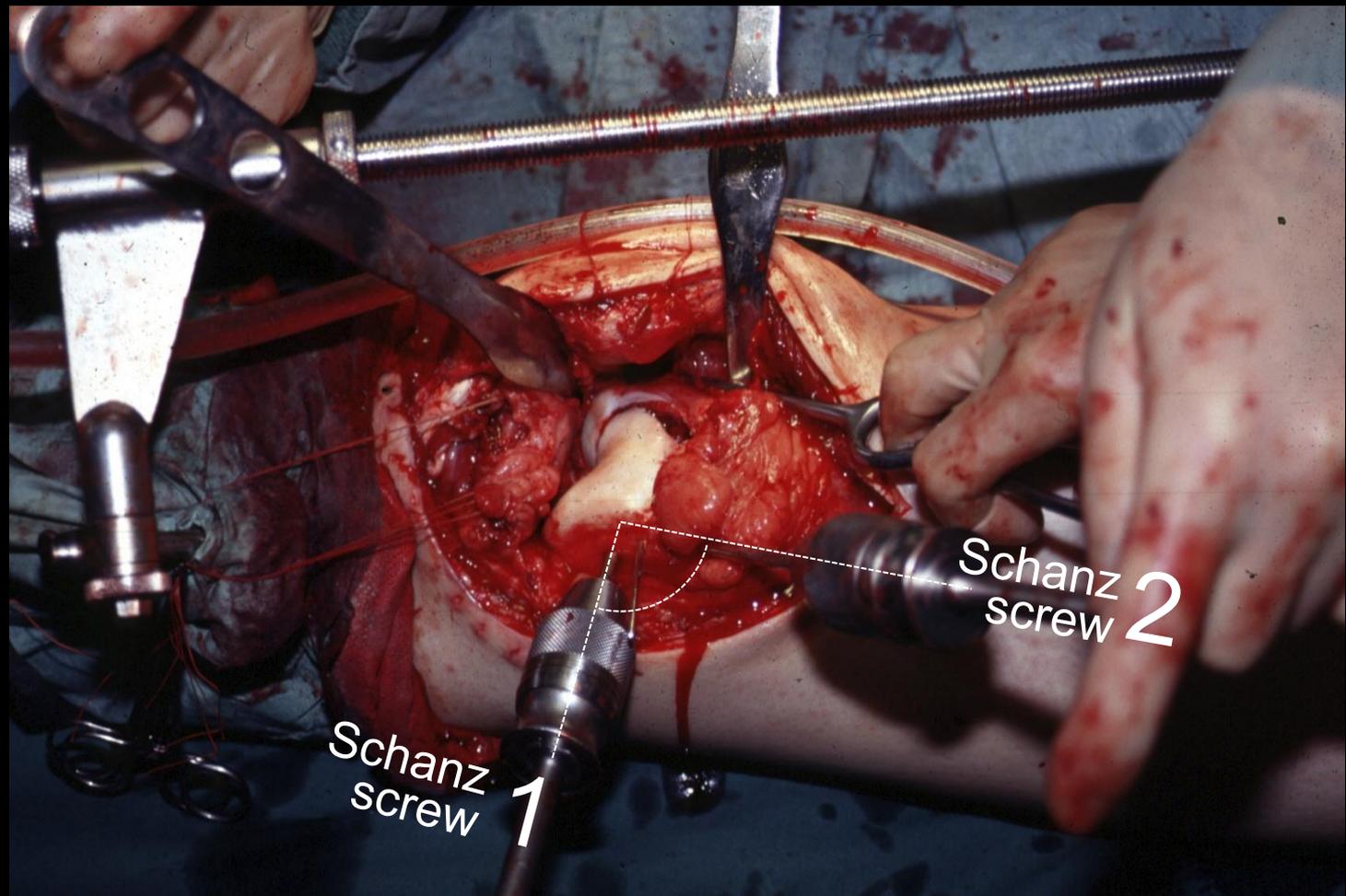
Schanz screws

T-Handle

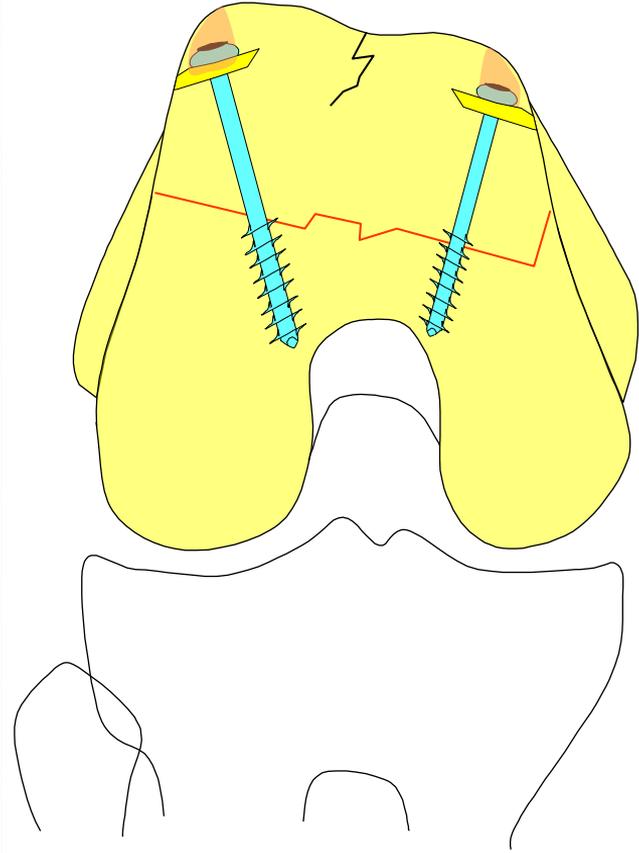
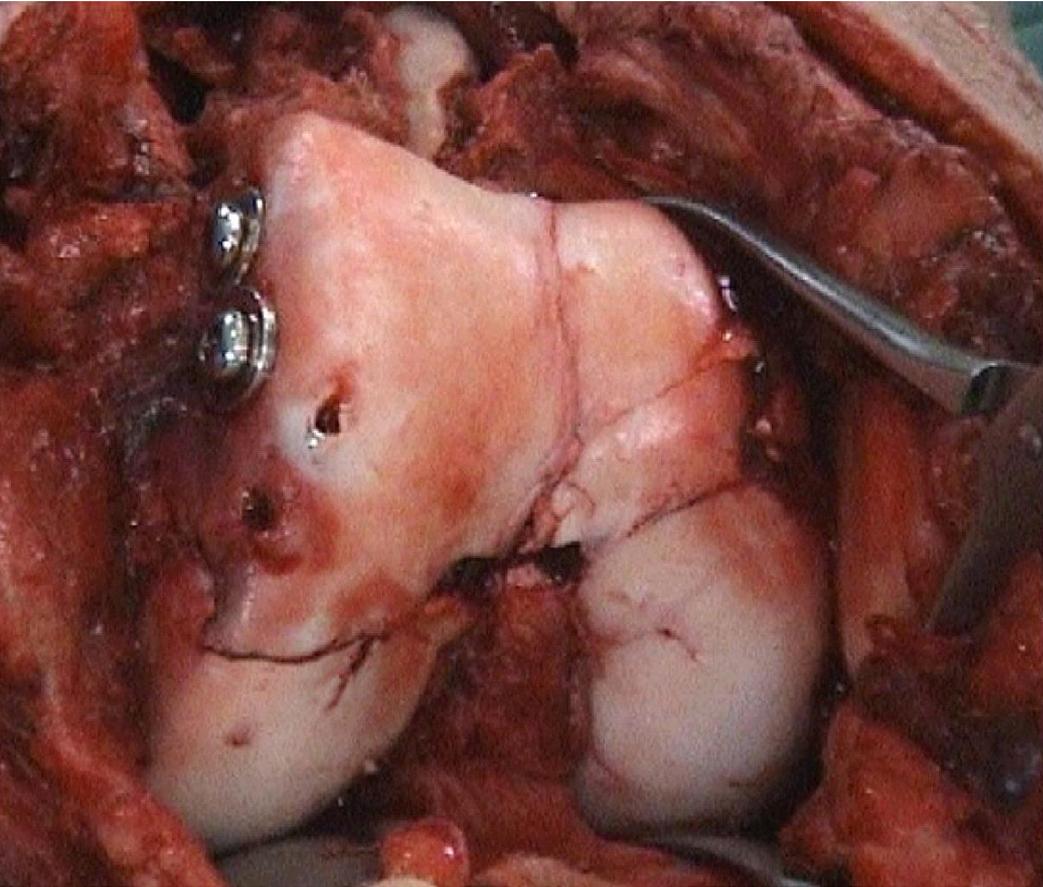
1 Joystick: biplanar
manipulation
3rd plane unreliable
(Schanz screws can
rotate)



2 Joysticks
controlled
3-plane
manipulation

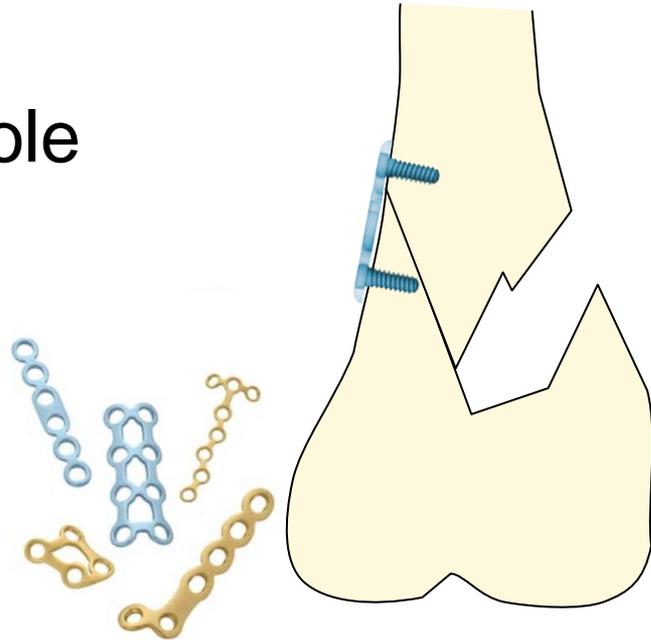


Problem horizontal fx lines



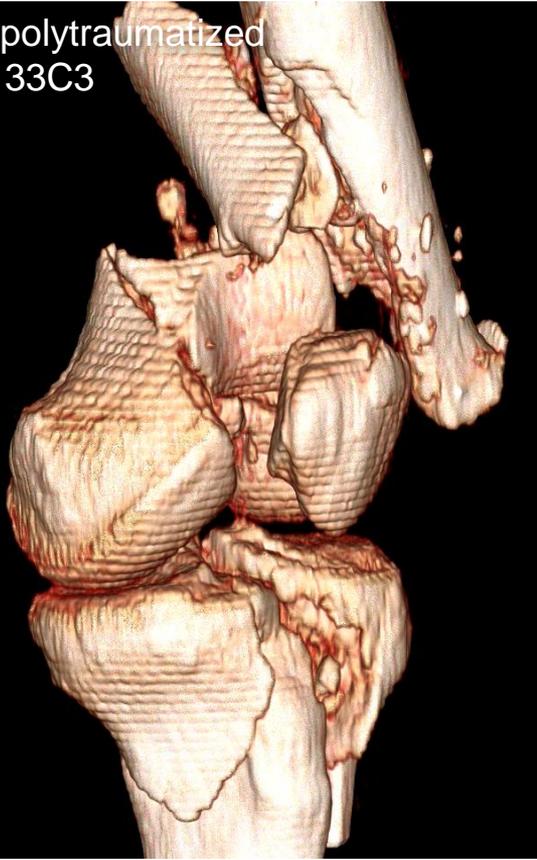
provisional fixation articular block to shaft

- K-wires
- distally fixed plate
- small plates (1/3 tubular, 2-hole mini plates from hand set)
 - anti-glide function
 - good temporary stability
 - still some flexibility (torsion, varus/valgus)
 - minimal periosteal damage

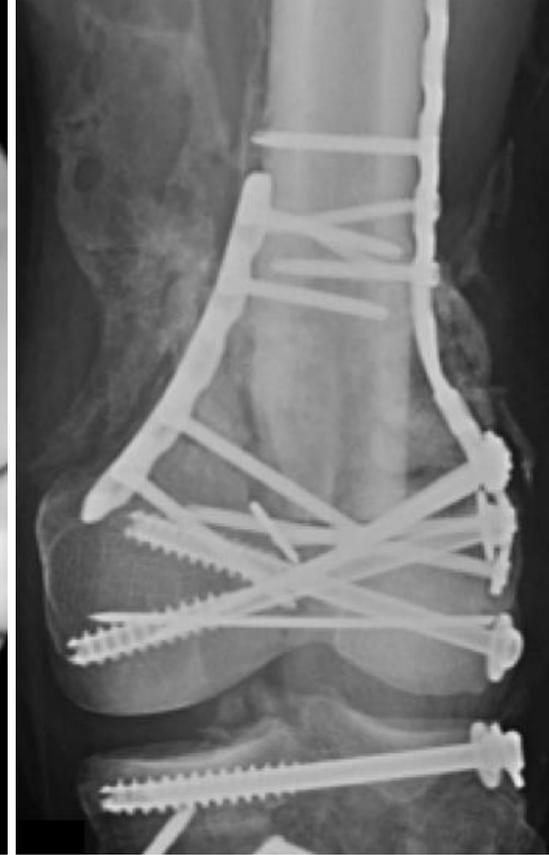


provisional fixation articular block to shaft

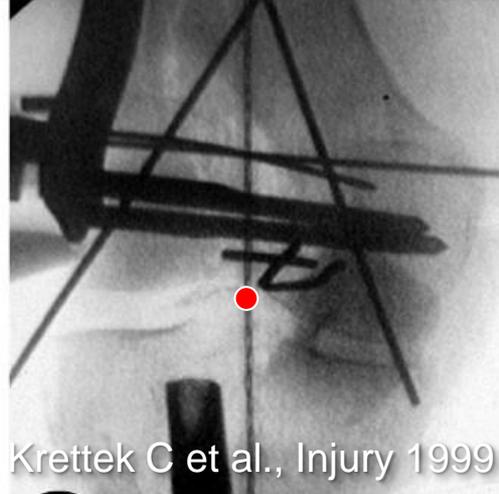
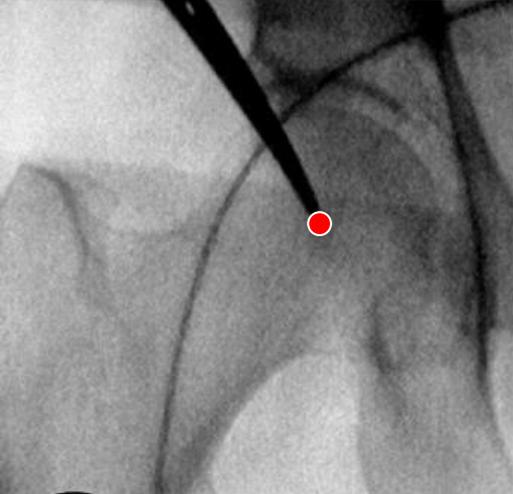
59 y polytraumatized
O3B 33C3



primary shortening
resection+impaction
plan:
lengthening after
complete fx healing



Frontal plane alignment: Cable technique

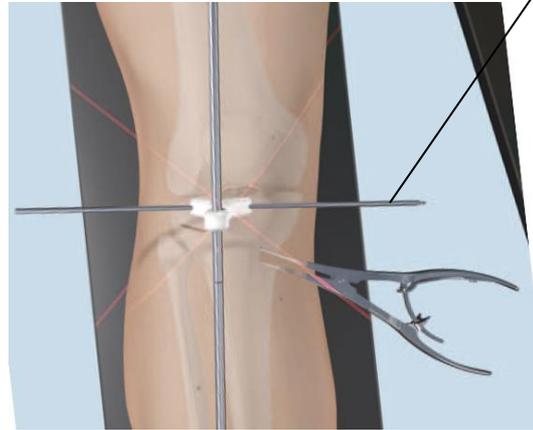


Alignment rod +++ helpful in floating knee situations

59 y polytraumatized
O3B 33C3



90° reference clip



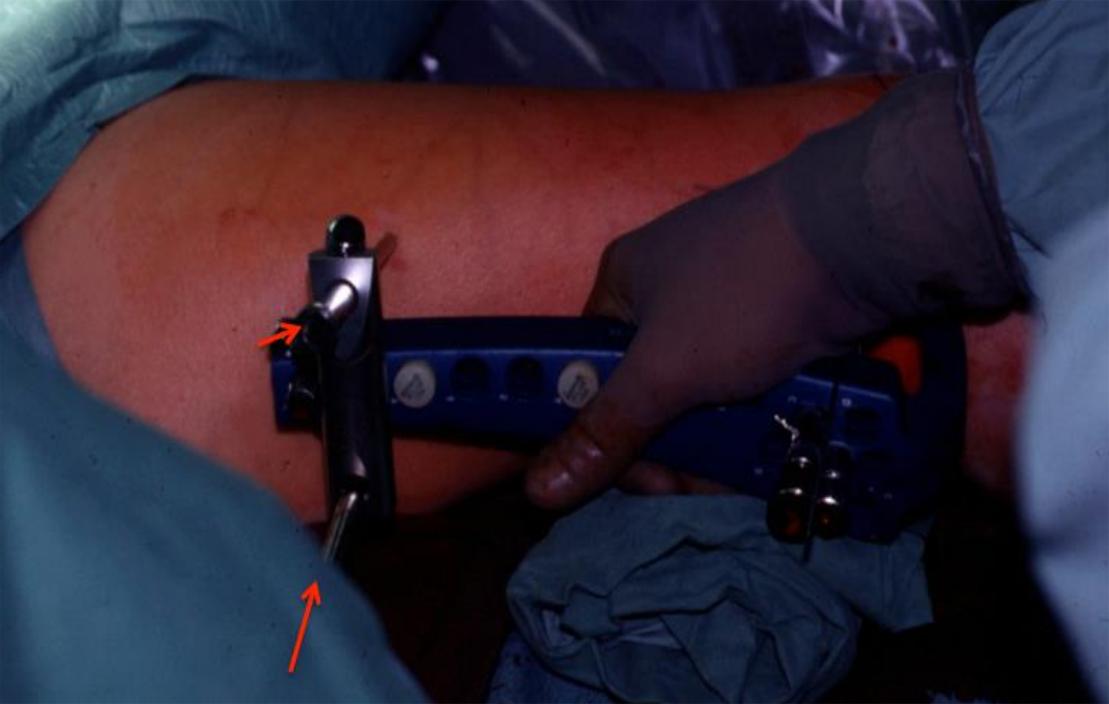
Secondary lengthening after distal fx healing



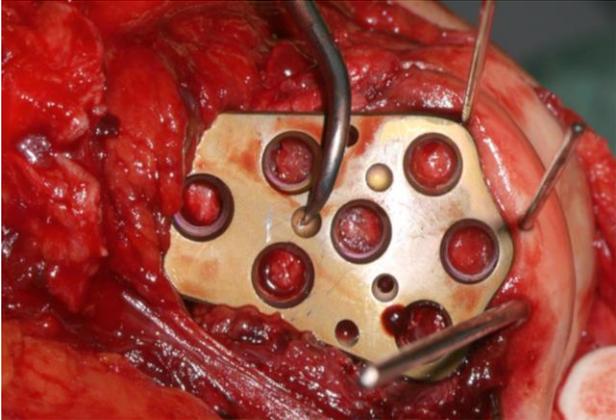
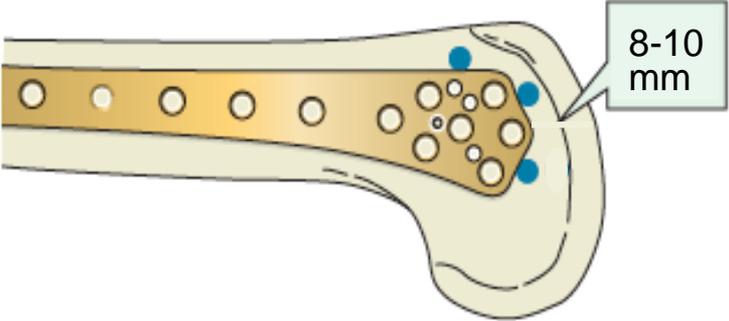
FU 4y
VAS 3
SF 36 phys health 40 (45)
WOMAC 24/100 (best 0)
Lysholm 65/100 (best 100)

Plate placement: Fencing

proximal K-wire fence

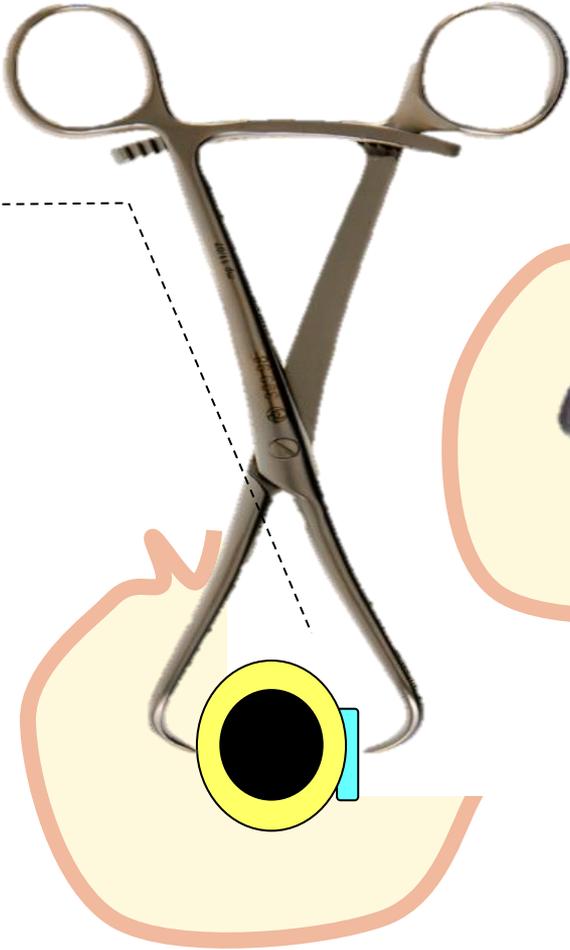


distal K-wire fence



traditional
bone clamp:

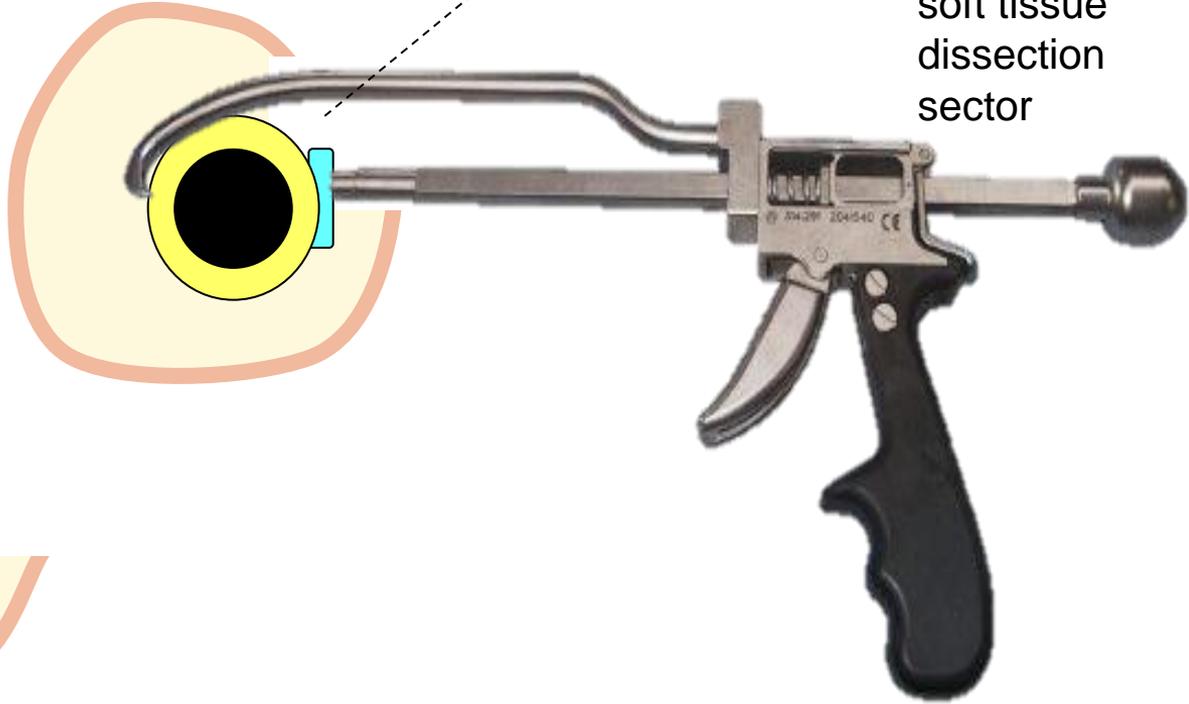
large (90°)
soft tissue
dissection
sector



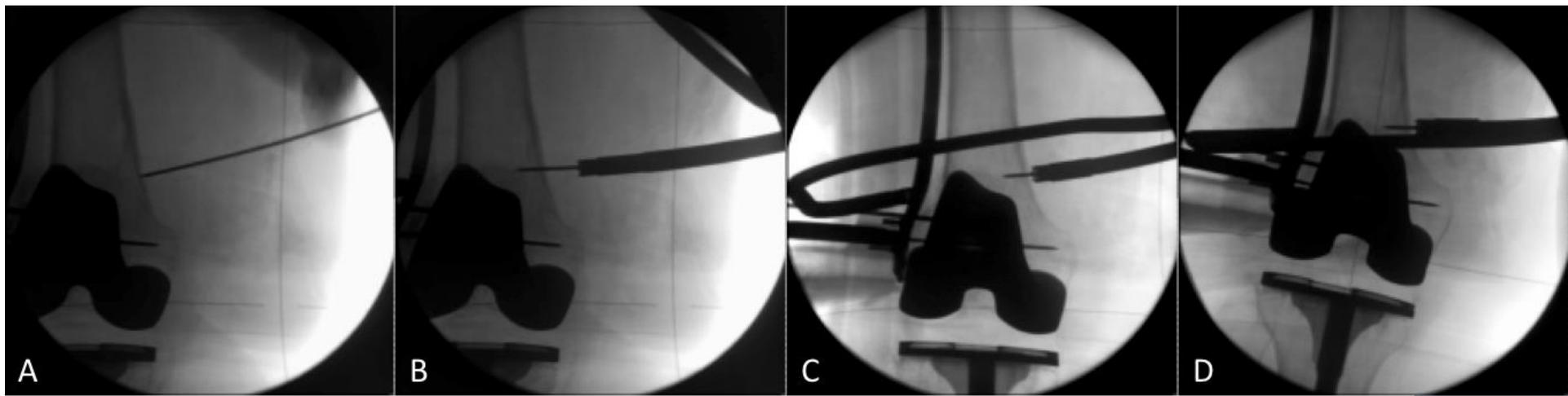
temporary plate fixation

colinear
bone clamp:

small (30°)
soft tissue
dissection
sector



Problem temporary plate fixation: avoid slipp off with K-wire in colinear clamp

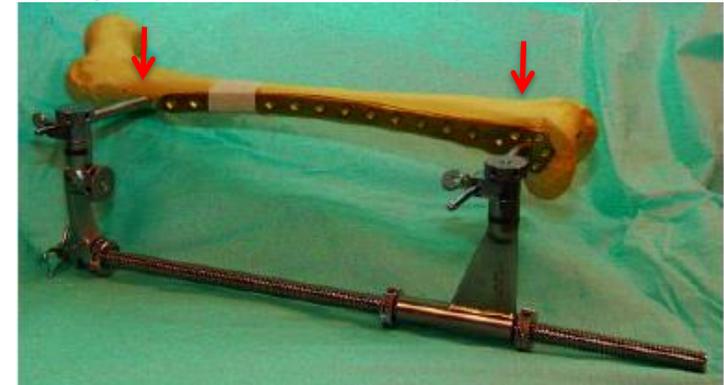


Large Distractor: pin options

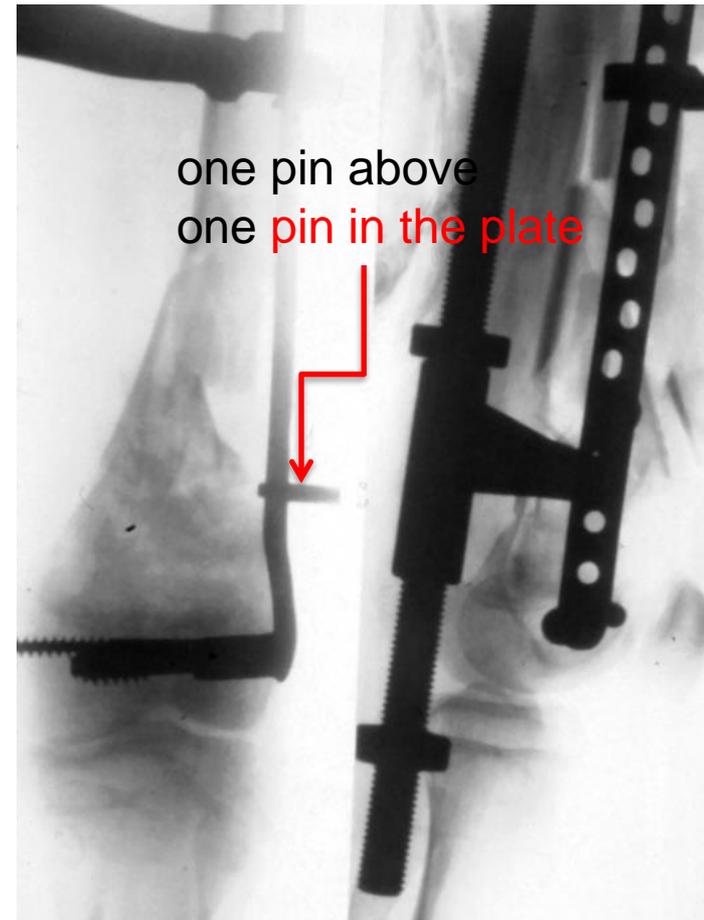
Distal: in proximal tibia
excludes knee motion and
limits access to distal femur.

... **distal pin placement in plate:**
control length, still play with
rotation and frontal/sagittal plane

one pin above ... one **pin in the plate**



Babst R. et al. Unfallchirurg 2001 104(6):530-535

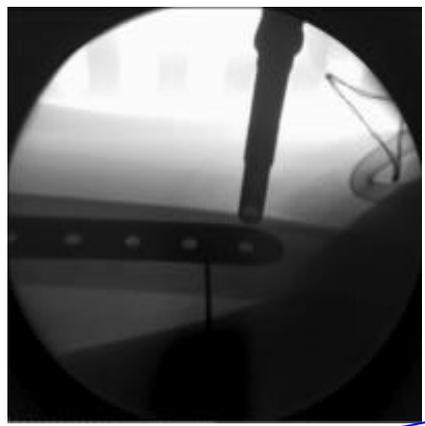




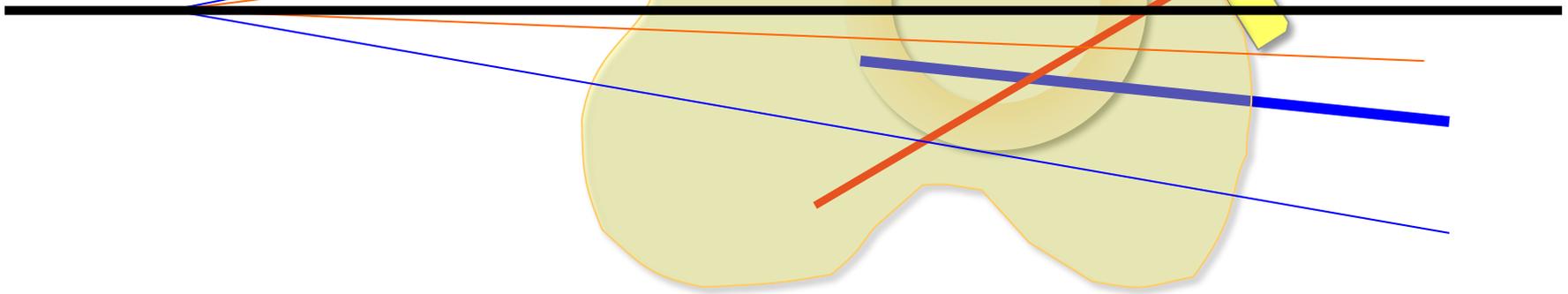
Question:
is the plate centered
properly ?

Don't get fooled by projection errors

xray beam vector is not vertical to plate vector



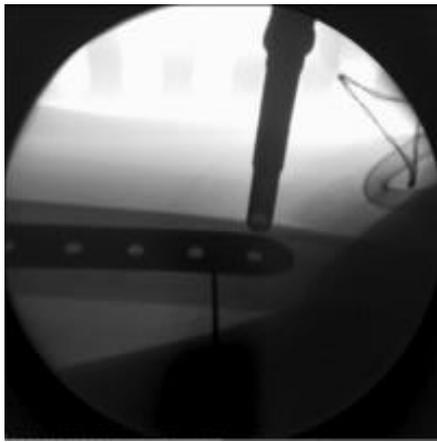
x-ray beam



technical details

1) anti-slip off K-wire fencing

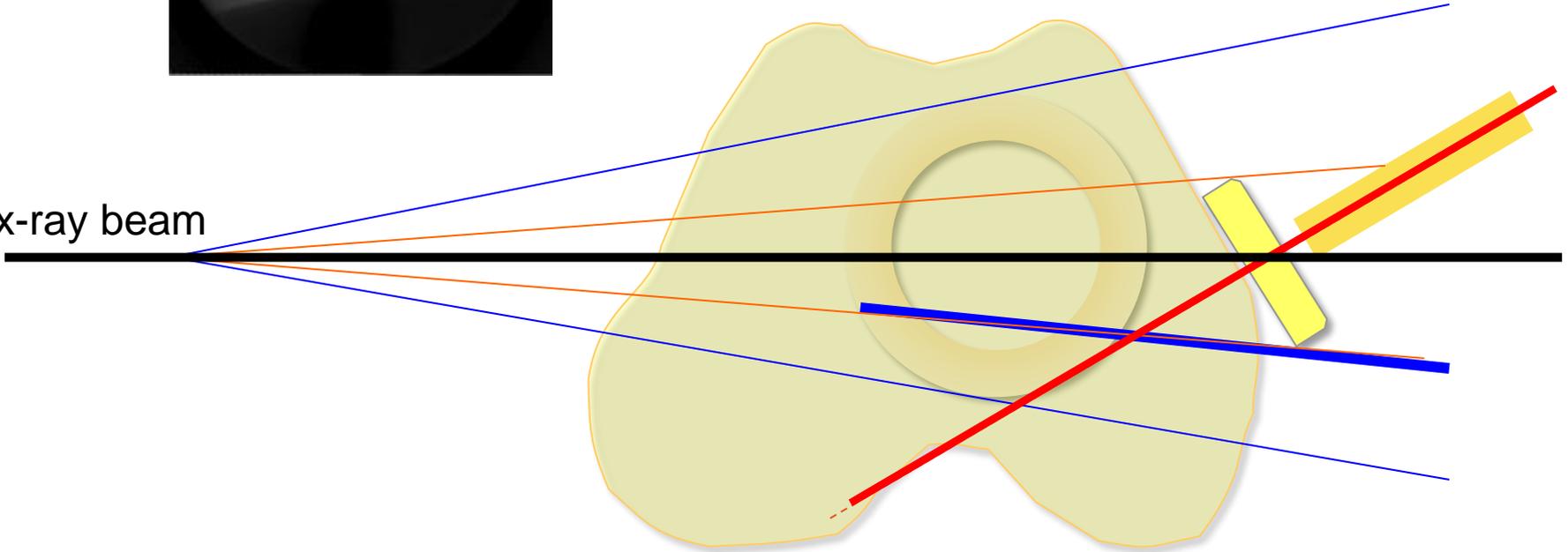
2) be aware of projection errors



technical details 1) fencing anti-slip
off K-wire

2) be aware of
projection errors

x-ray beam



M. Ruth 88y

fall on the left hip



Ruth M. 86y

1 week postop surgery



Ruth M. 86y after revision (longer plate, additional cerclage wires)

	shear restanc e	pullout resistance
cerclage	-	+++

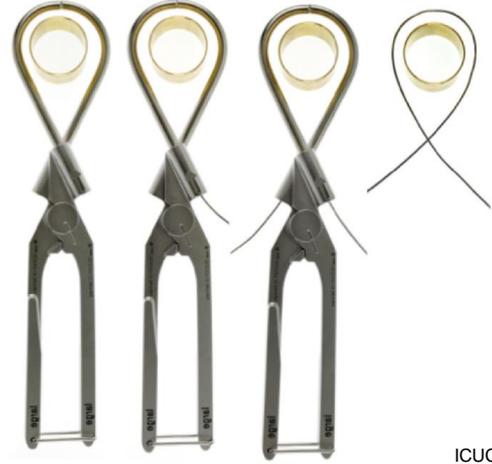
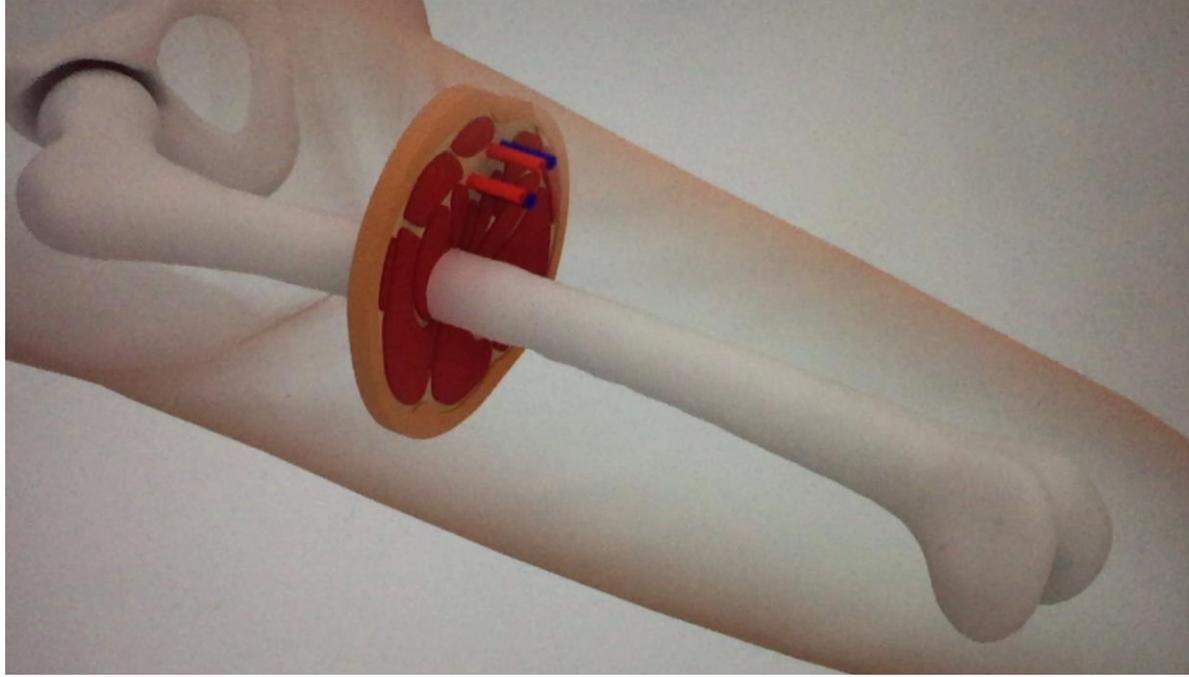


Ruth M. 86y after revision (longer plate, additional cerclage wires)

	shear resistance	pullout resistance
cerclage	-	+++
screw	+++	-
combination	+++	+++

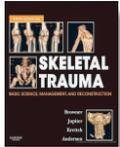
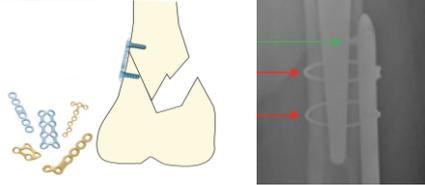
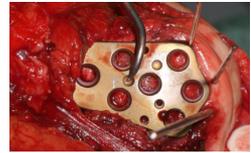
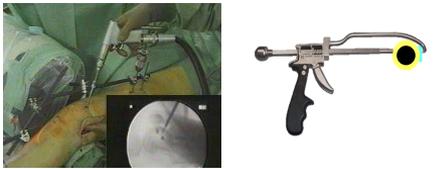
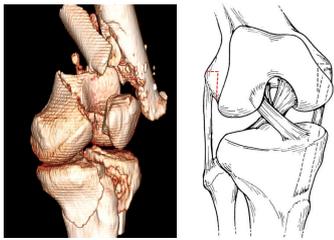


2 component cerclage wire passer



Summary Fragment Specific Fixation

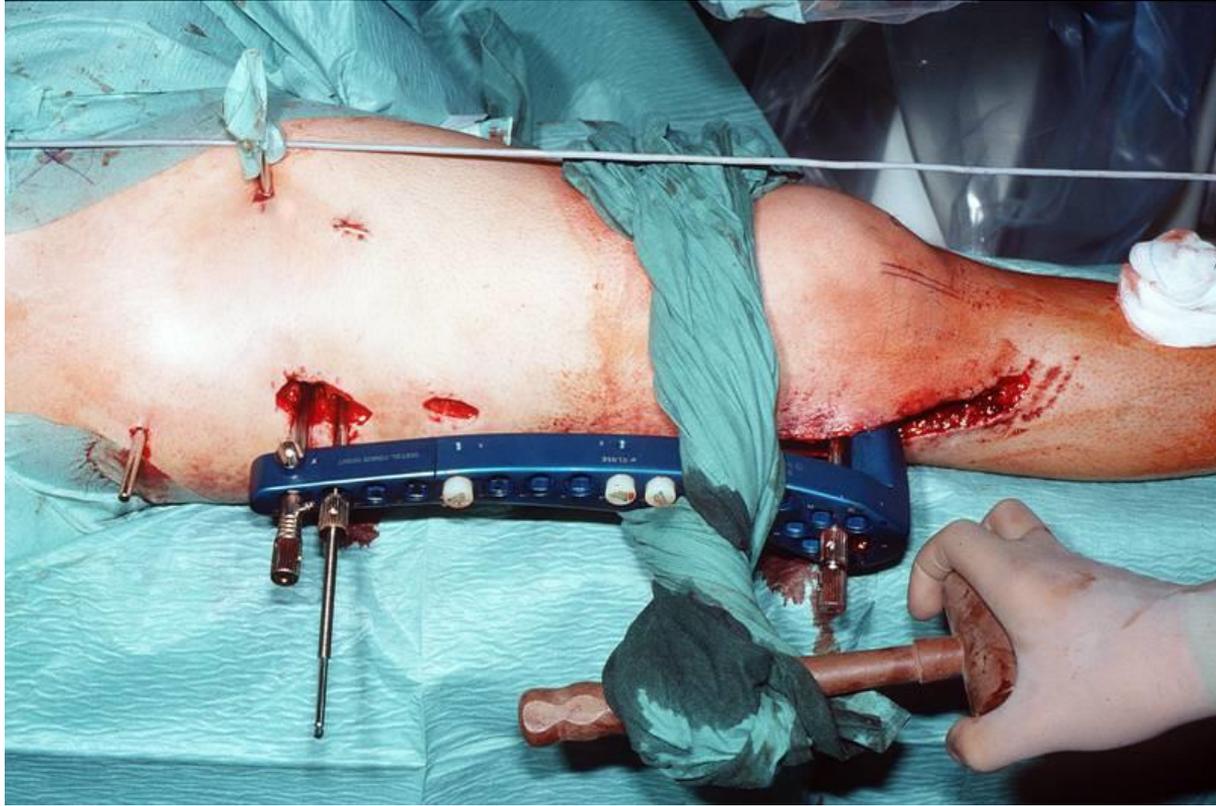
- **Preop** alignment analysis contralateral side ... workshop (length, rotation, hyperextension)
- **Approaches** different for extra- & intraarticular fx option: epicondyle osteotomy
- **Reduction** tools (distractor, joystick, spreader, Listractor, colinear clamp, cerclage wire passer)
- **Fixation** concepts
Miniplates
Fencing w K-wire cage
Cerclage-locking screw combination



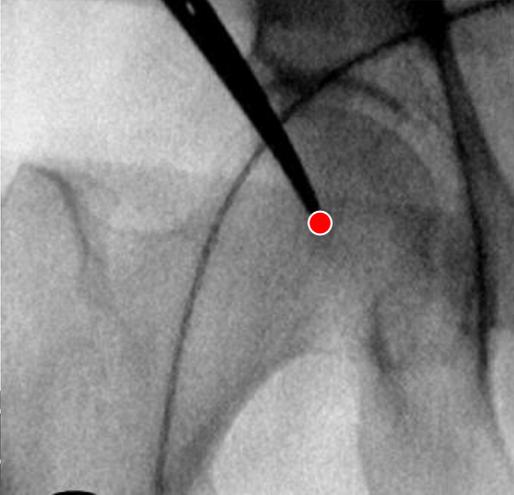
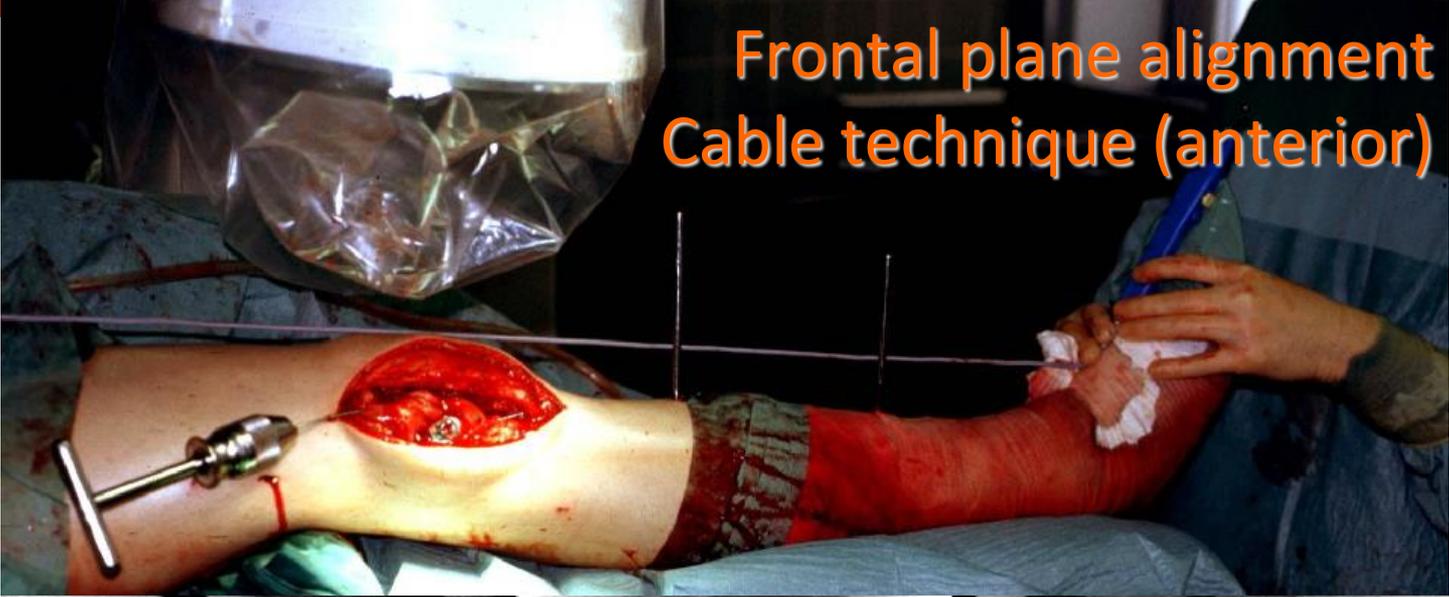
Krettek C Fractures of the Distal Femur.
In: Skeletal Trauma.
Editors Browner BD, Jupiter JB, Krettek C, Anderson P
5th ed: Saunders Elsevier; 2015



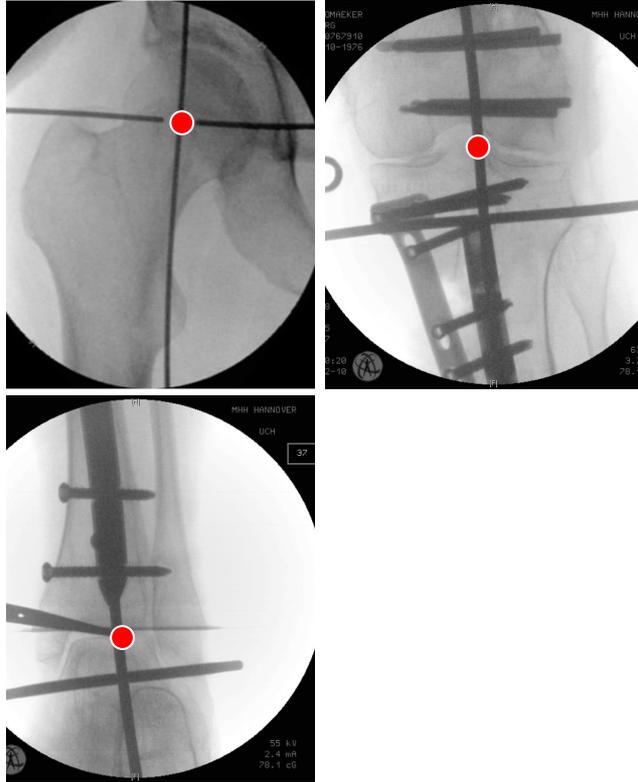
Reduction Tricks: Towel



Frontal plane alignment Cable technique (anterior)



Frontal plane alignment Alignment Grid (posterior)



underneath patient
underneath padding

- good precision
(close to navigation)
- cheap
- flexible

disadvantage

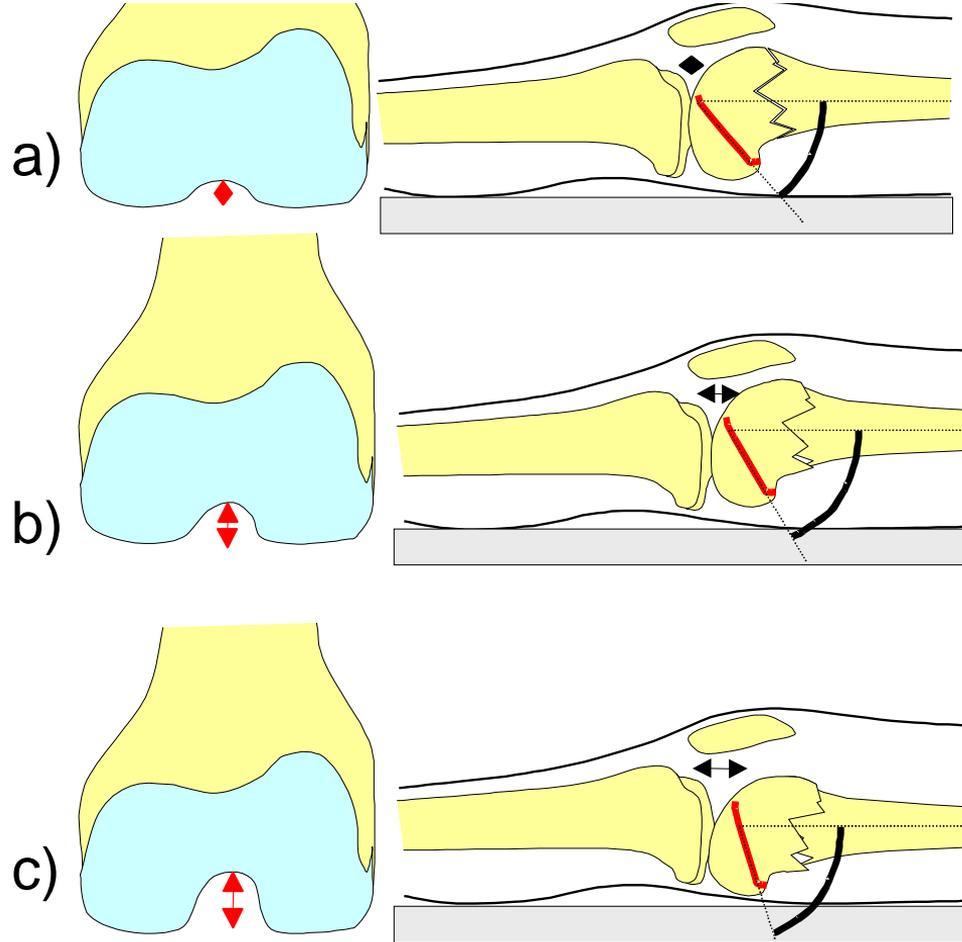
- radiation exposure
- only 2D

Liodakis E, Tech Health Care 2010
Krettek C, Injury 1999

genu recurvatum: notch sign

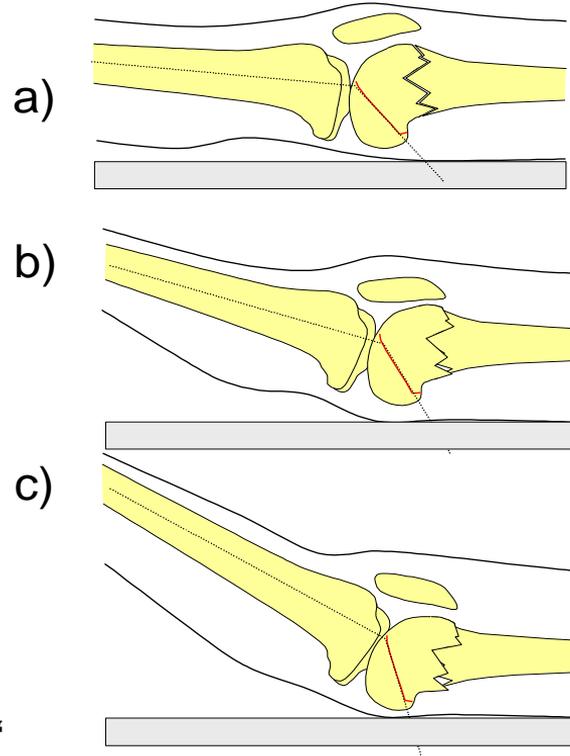


positive notch sign
if you see a notch like
this, the distal main
fragment is in
overextended position



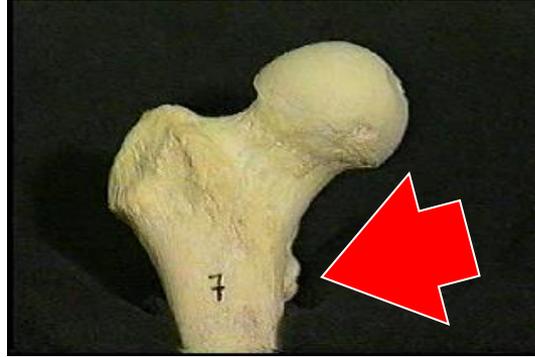
genu recurvatum: hyperextension test

... Full extension necessary for ante-recurvatum check



„Hyperextensions Test“

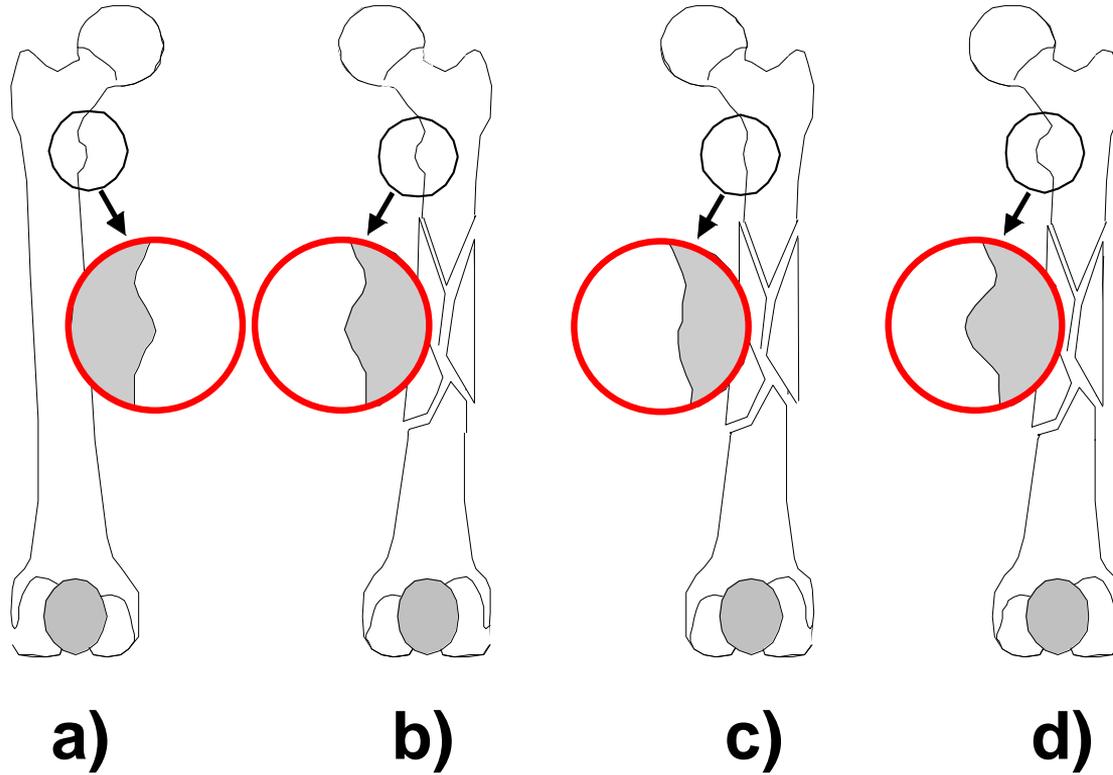
How Can we Control Torsion? Lesser trochanter shape sign



comparison contra-lateral

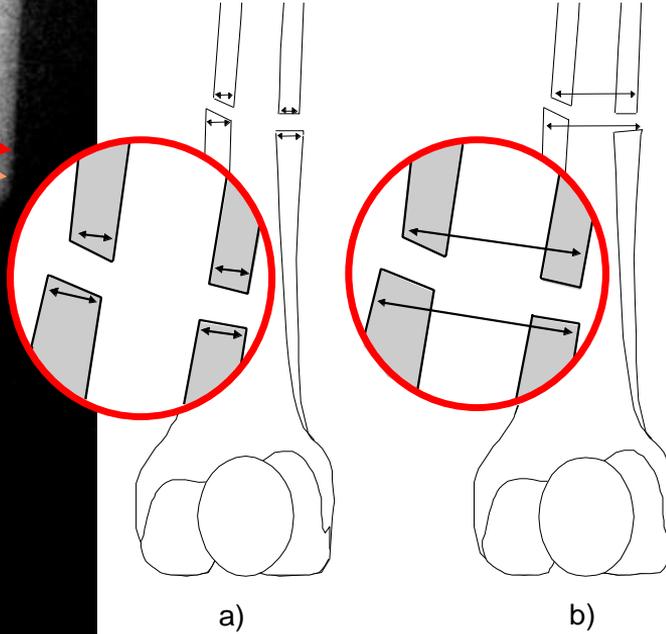
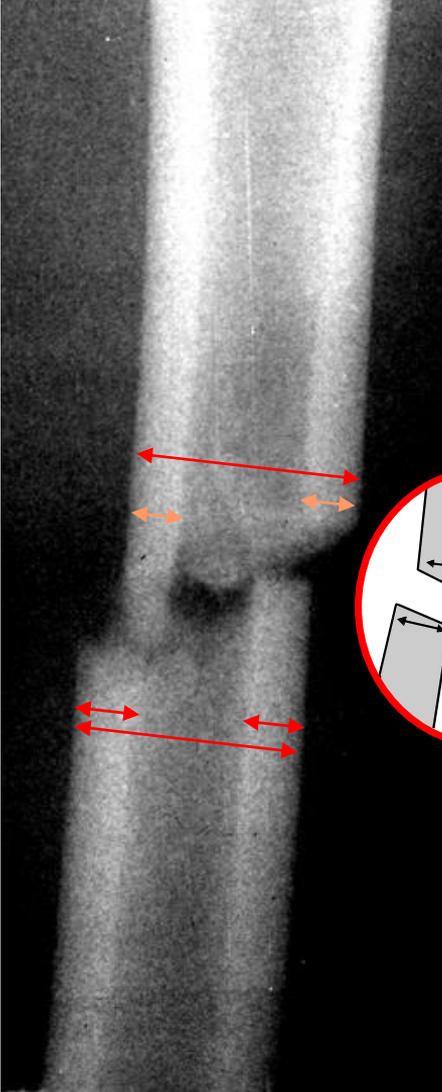
Krettek et al (1999) Injury 29, Sup 3

Lesser trochanter shape sign



Kim JJ, Kim E, Kim KY (2001)
Predicting the rotationally neutral state of the femur by comparing the shape of the contralateral lesser trochanter. Orthopedics 24: 1069

Cortical step sign & Diameter difference sign



parallel to joint = correct alignment?
non parallel = malalignment

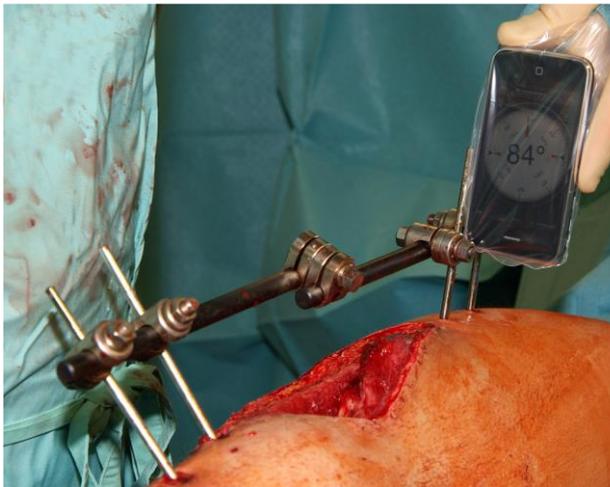


parallel to joint = correct alignment?
non parallel = malalignment



iPhone supported Torsional Correction

MHH ethic committee approved, clinical study 2010/2011)



prox: 84°

distal: 57°

correction & calculation according
CT scan data

Warning: off label use!!!

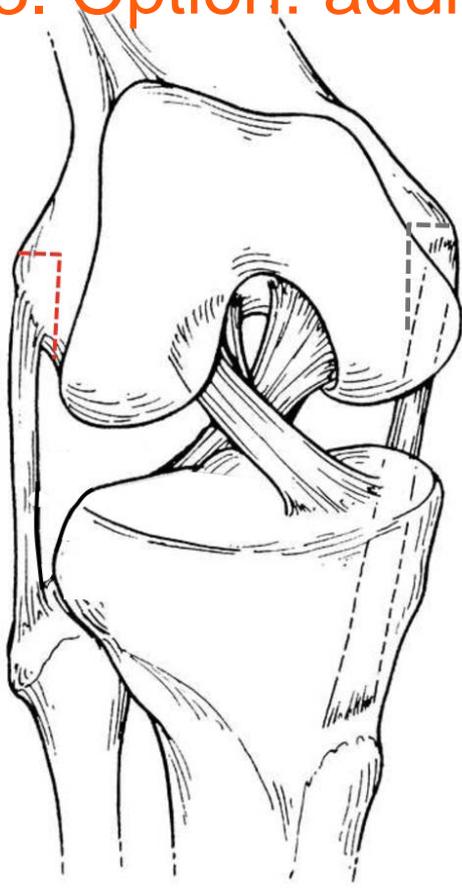
Summary Obtaining/Maintaining Reduction

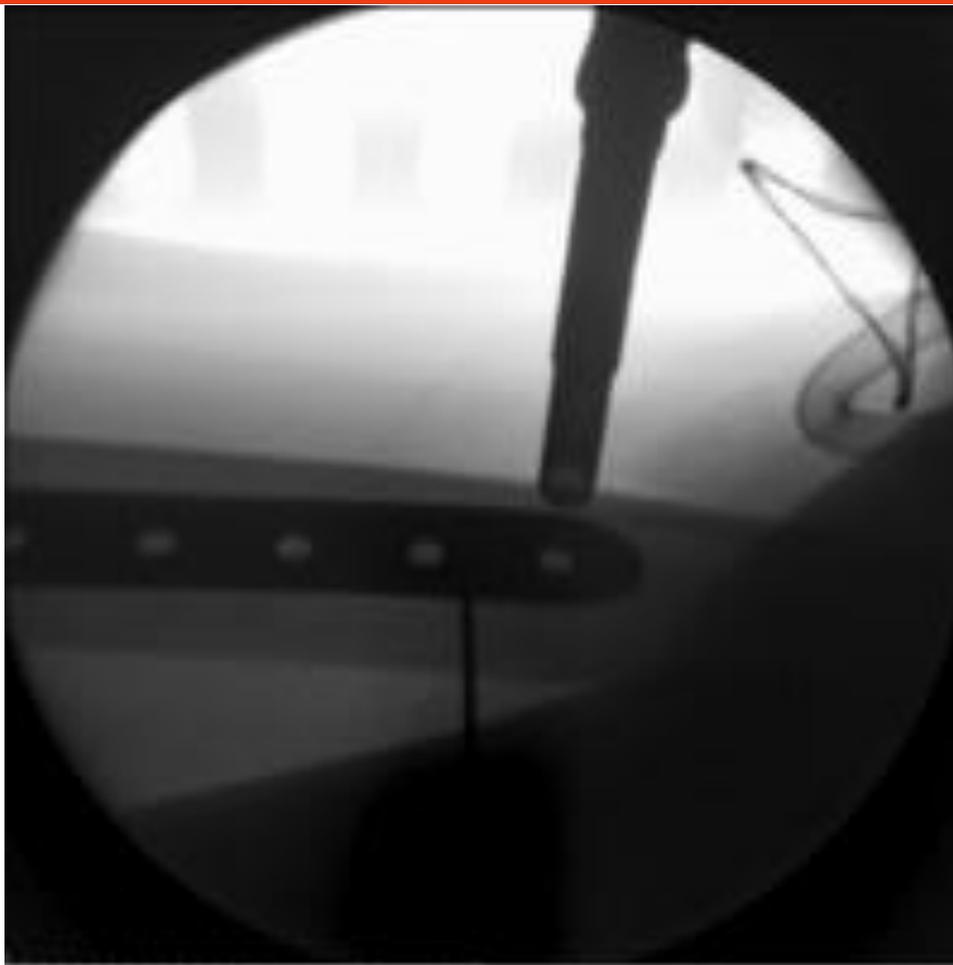
- preop analysis contralateral side (length, rotation, hyperextension)
- positioning / approach planning
- reduction tools (distractor, joystick, spreader, Lisstractor, colinear clamp)
- alignment control
cable technique, lesser troch, hyperextension test

reduction aids

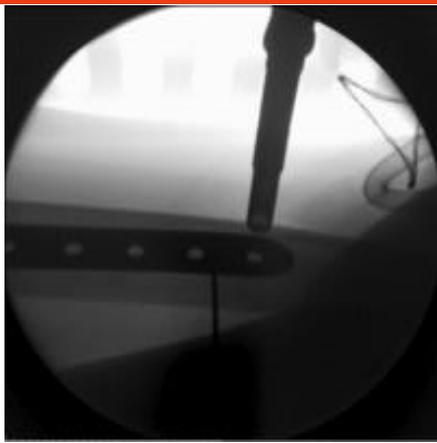


3. Option: additional epicondyle OT (B1-3)



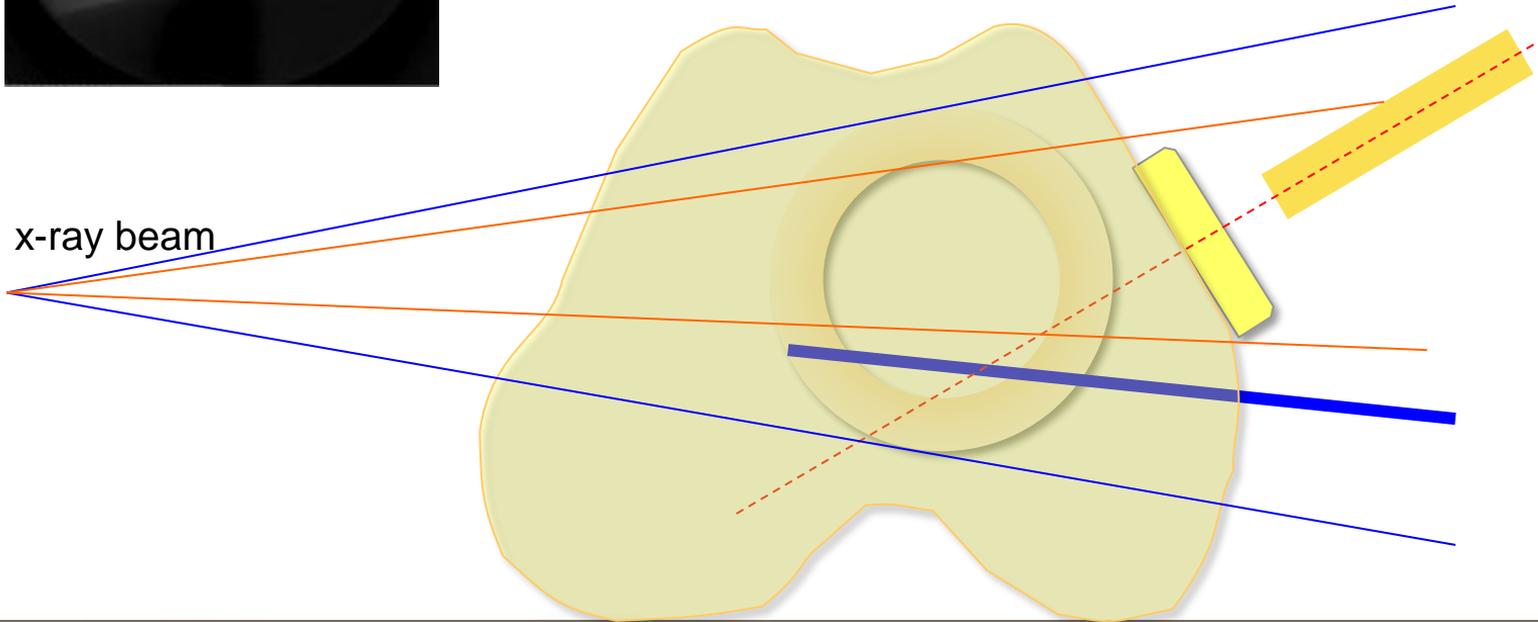


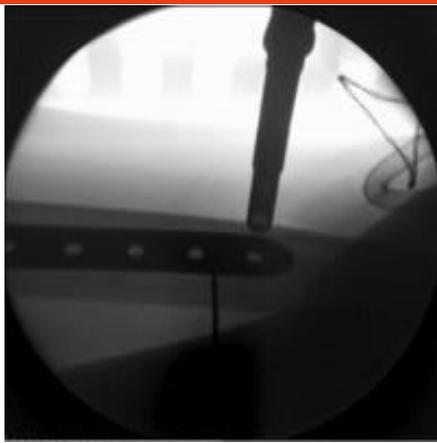
Question:
is the plate
centered properly
?



technical details

- 1) anti-slip off K-wire
- 2) be aware of projection errors





technical details

1) anti-slip off K-wire

2) be aware of projection errors

x-ray beam

