DUROM Resurfacing & LDH

JECOT, Rabat (Septembre 2010)

A. Rodriguez MD; PhD

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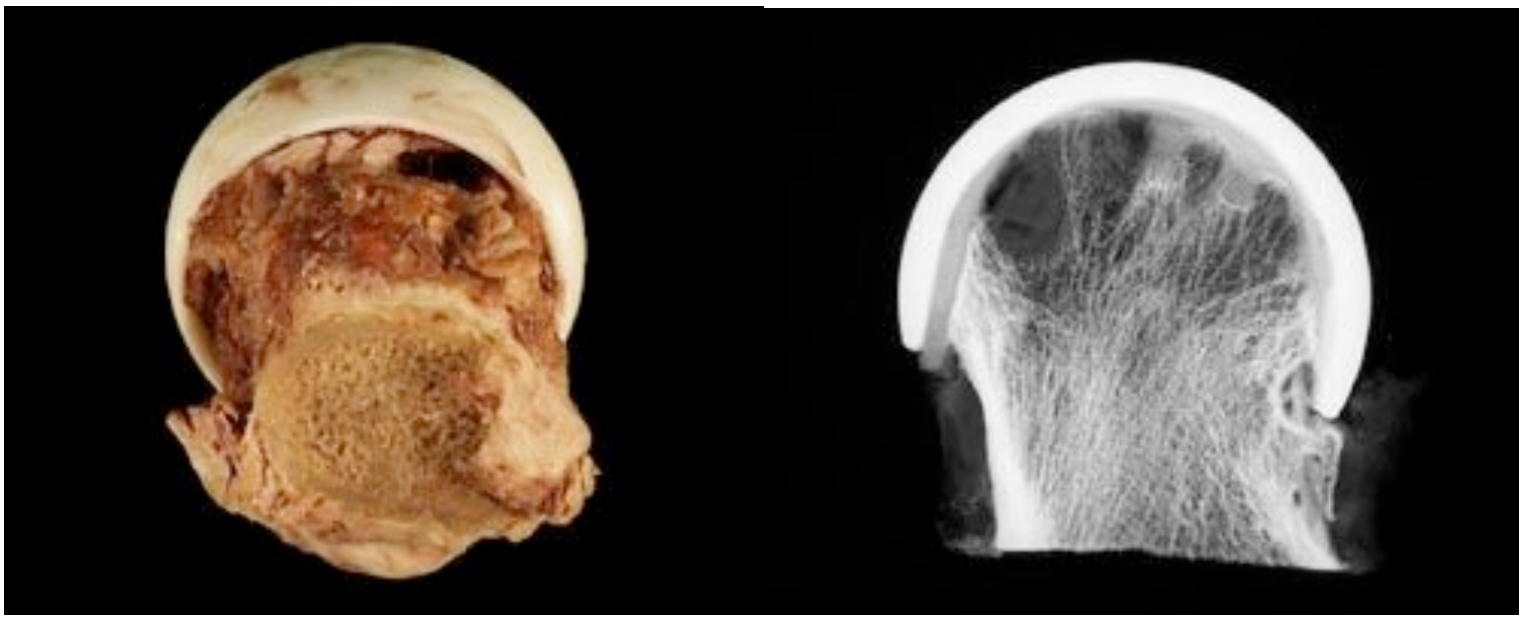
Charnley

Teflon-Teflon

- Catastrophic wear
- Loosening
- Osteolysis



Freeman
Fukuda

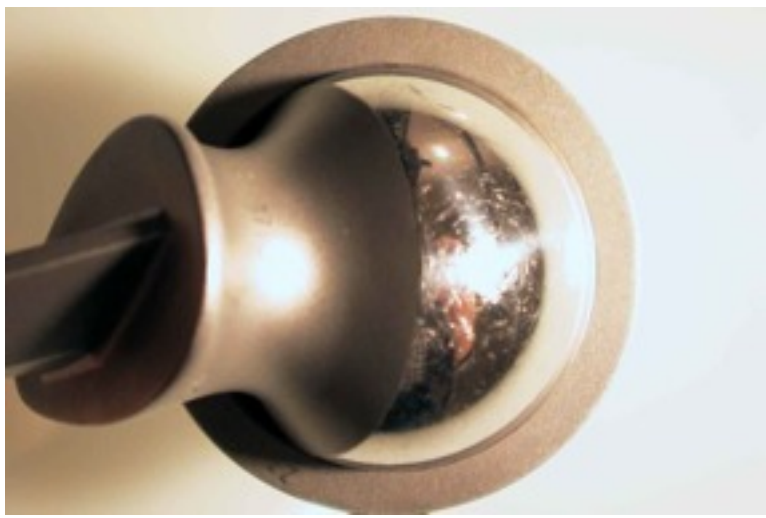
- Metallic cup
- PE head

Wagner
Amstutz

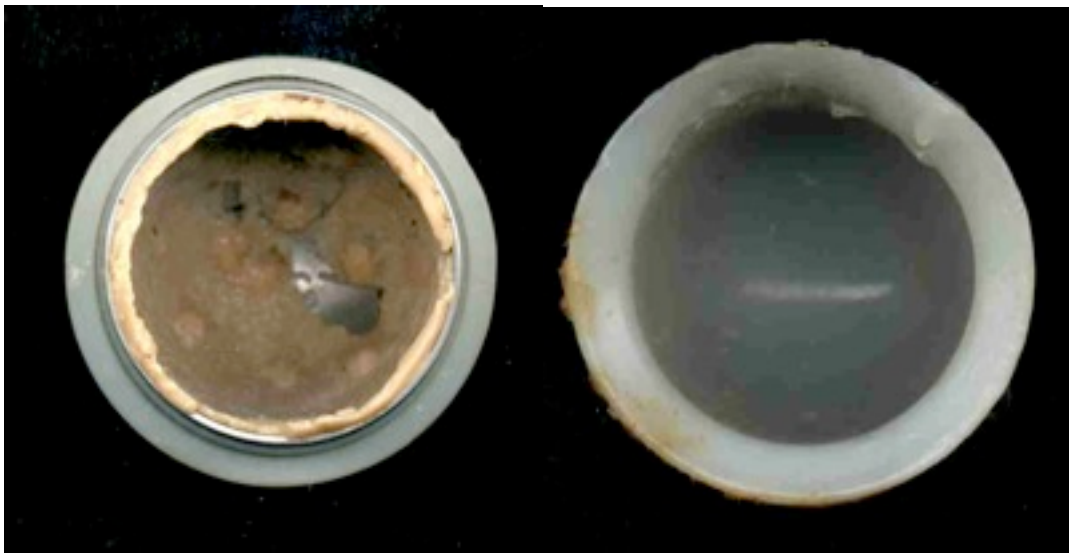
- PE cup
- Metallic head

Wear

- Materials quality
- Poor metallurgical knowledge
- Bad finishing
- Sphericity mismatch
- No clearance
- Bad mechanical strength



Bone cement quality



Reasons of problems

- Poor quality of materials
- Inadequate manufacture
- Poor surgical technique
  - Femoral neck superior notching
  - Varus positioning

… why we use now the same principle ?...

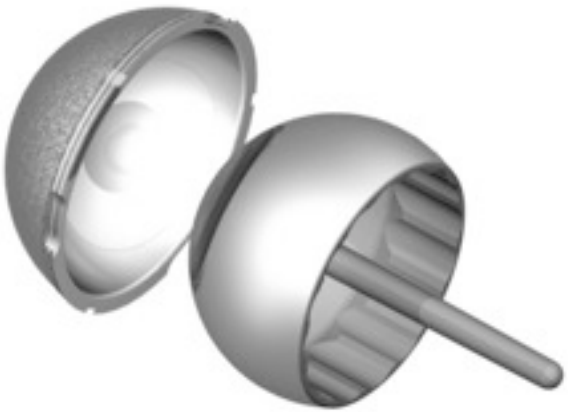
Metasul

- 30 years experience
- Alternative bearing to ceramics
- Young patients

- Personal experience on Metasul
  - > 600 Metasul THR's
  - excellent results
  - no wear
  - no osteolysis

Theoretical advantages

- Minimal bone resection
- Normal femoral loading
- Avoidance of stress shielding
- Restores normal anatomy
  - Offset ?
  - Leg length ?
  - Anteversion ?
- Reduced wear (MoM bearing)
- Better joint stability (big ball effect)
- Minimal risk of dislocation
- Better ROM (165° cup)
- Easy revision

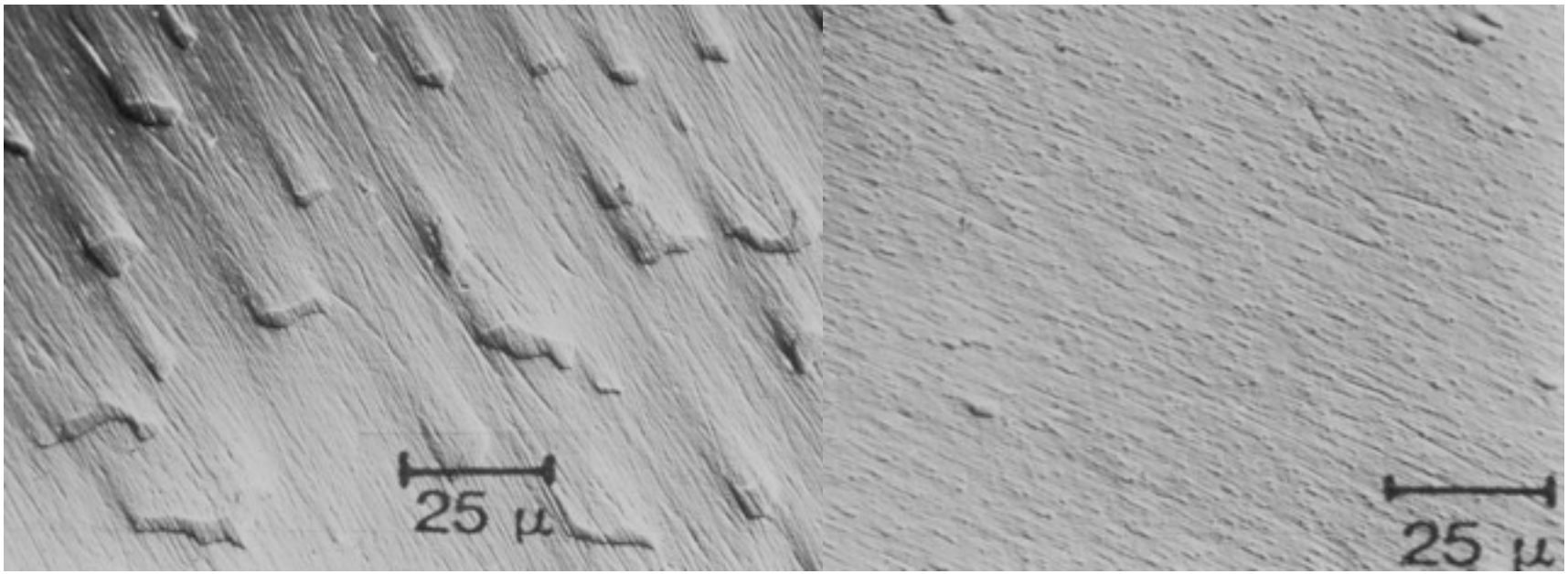


Cast

CoCrMo Alloy

Wrought

CoCrMo Alloy

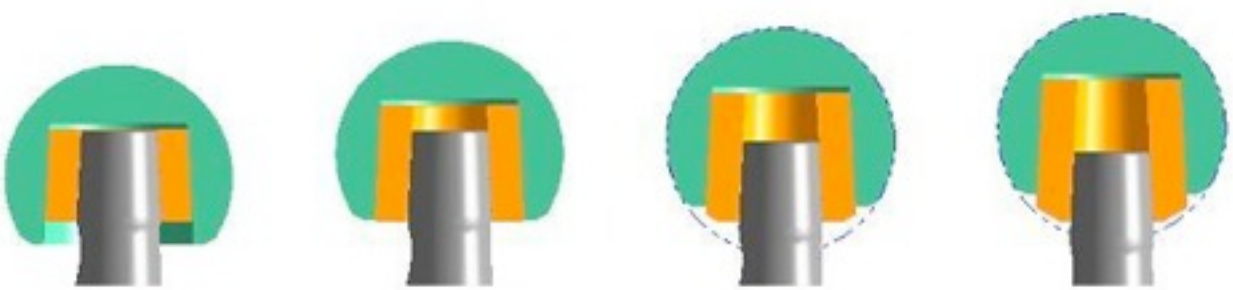


Manufacture

- Forged Metasul
- 20 year excellent clinical follow-up
- Full range of 2mm step implants
  - 38-60 mm head
  - 44-66 mm acetabulum

Large Diameter Heads (LDH) available

- modular cone (S/M/L/XL)
- available 12/14 and 8/10 neck adaptors

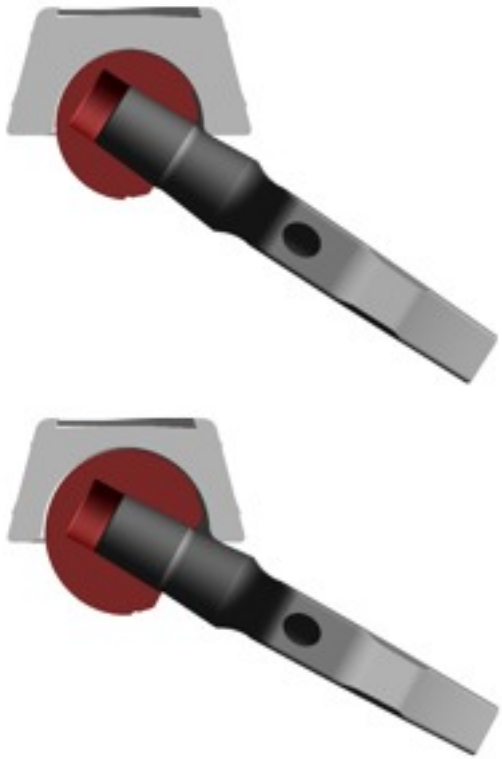


Full range of stems available as back-up if implantation is impossible

Large diameter heads

- Less impingement
- Less risk of dislocation
- Larger RoM
- Fluid film lubrication

Small or Large diameter heads ?

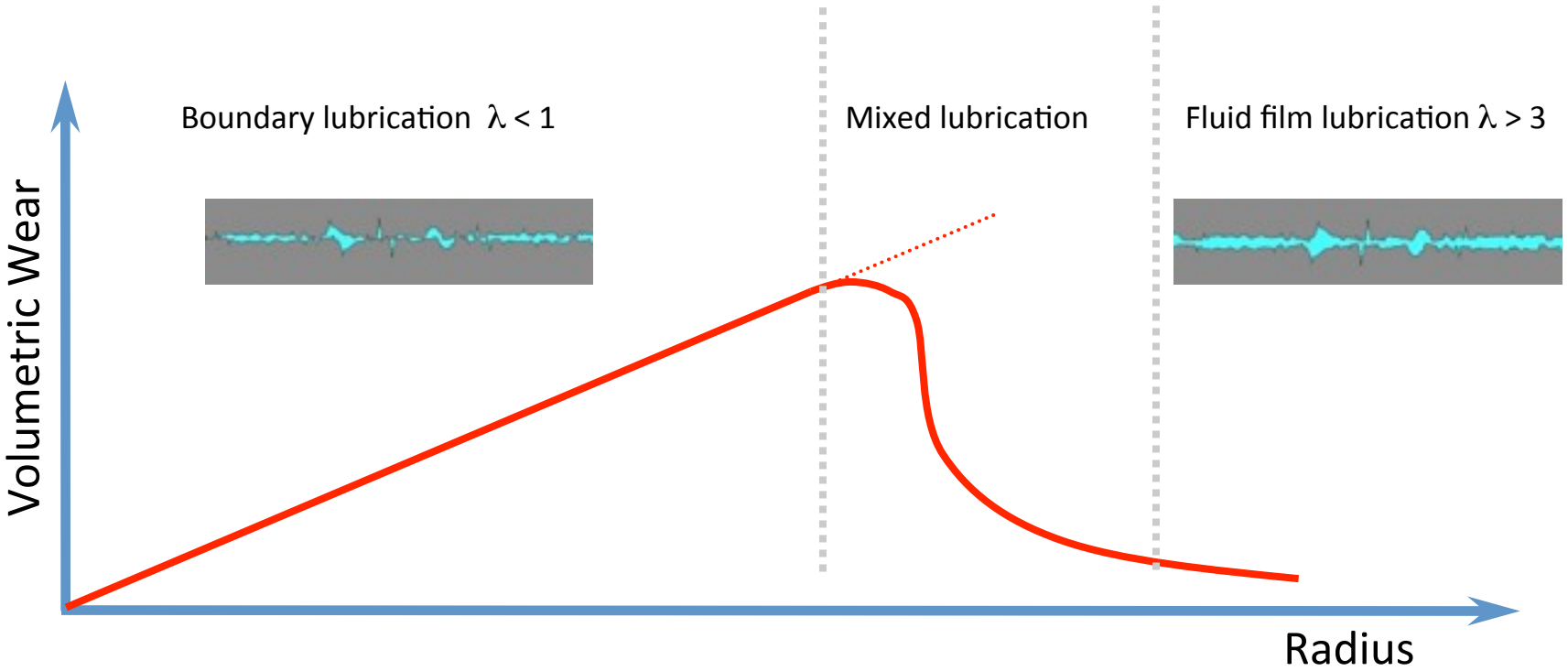


Large diameter heads

- Fluid film lubrication
- Lower friction
- Reduces wear

$$\lambda = \frac{Film\,thickness}{\sqrt{Ra_{Cup}{}^2 + Ra_{Head}{}^2}}$$

Fluid film lubrication is possible if $\lambda > 3$



- S.L. Smith et al., *Proc. Instn. Mech. Engrs*. 215, part H, 2001, p. 161

Large diameter heads

- Head/neck relationship

Large diameter heads

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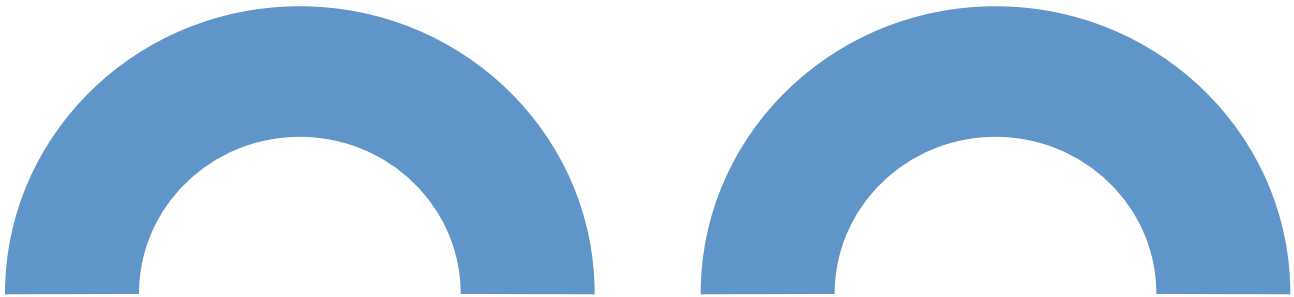
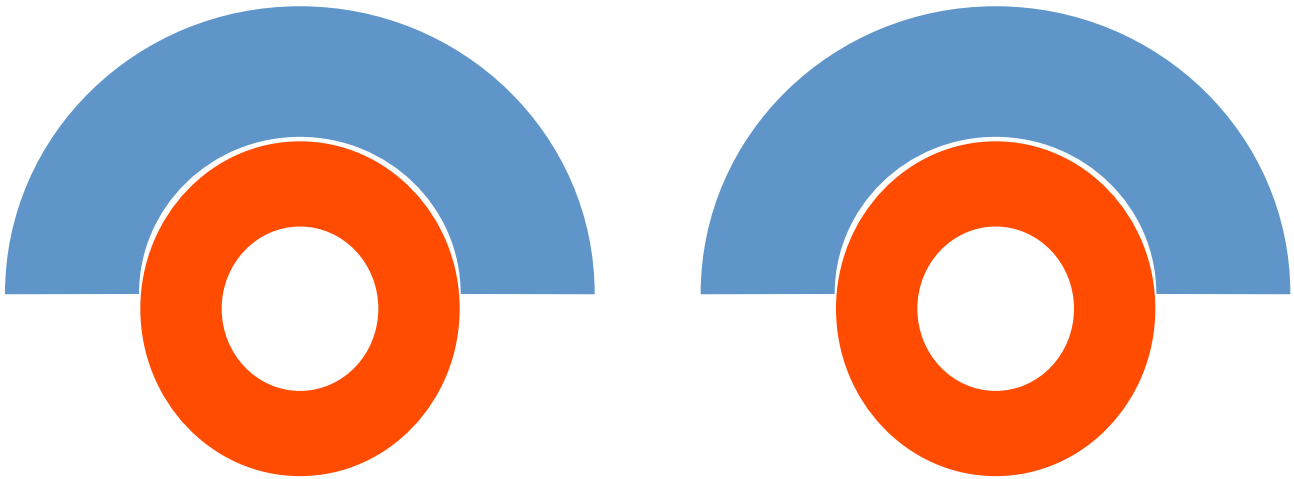


Large diameter heads

- Head/neck relationship



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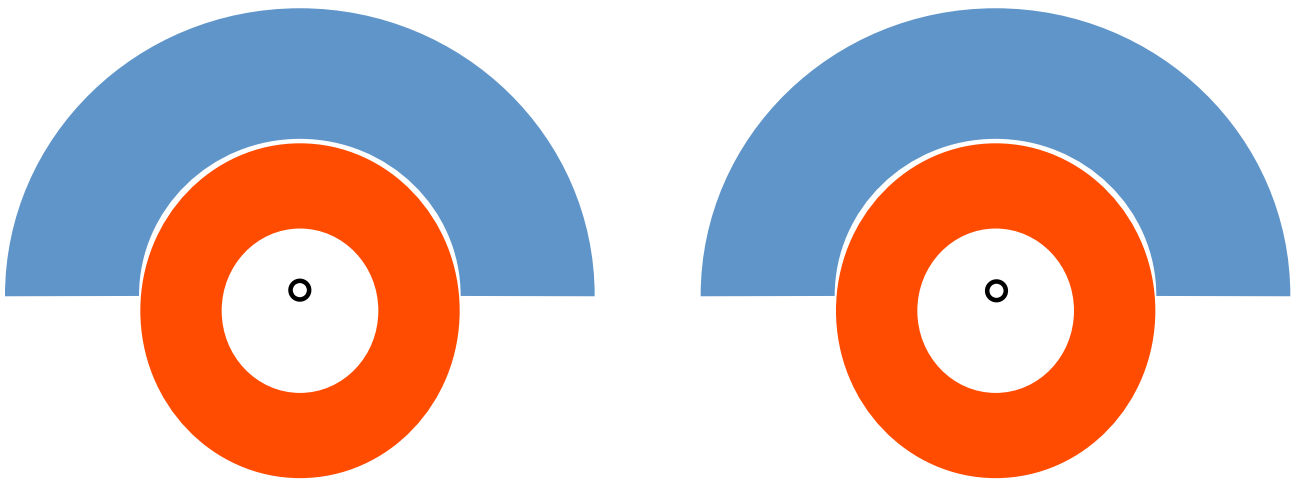

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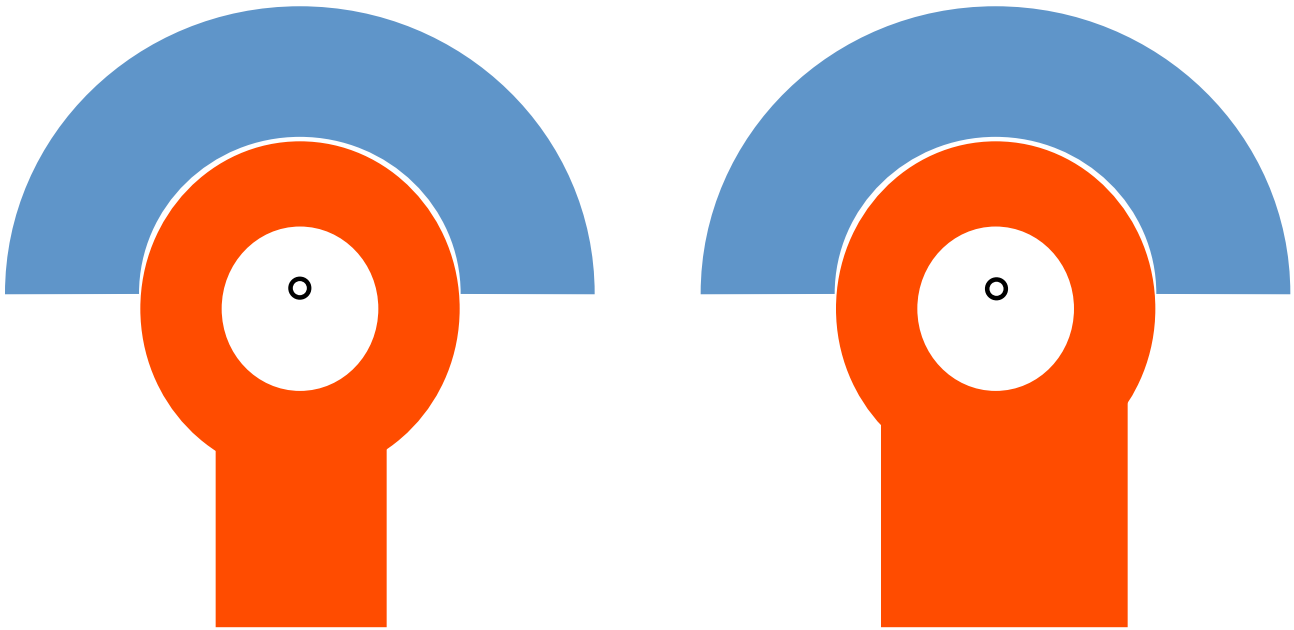

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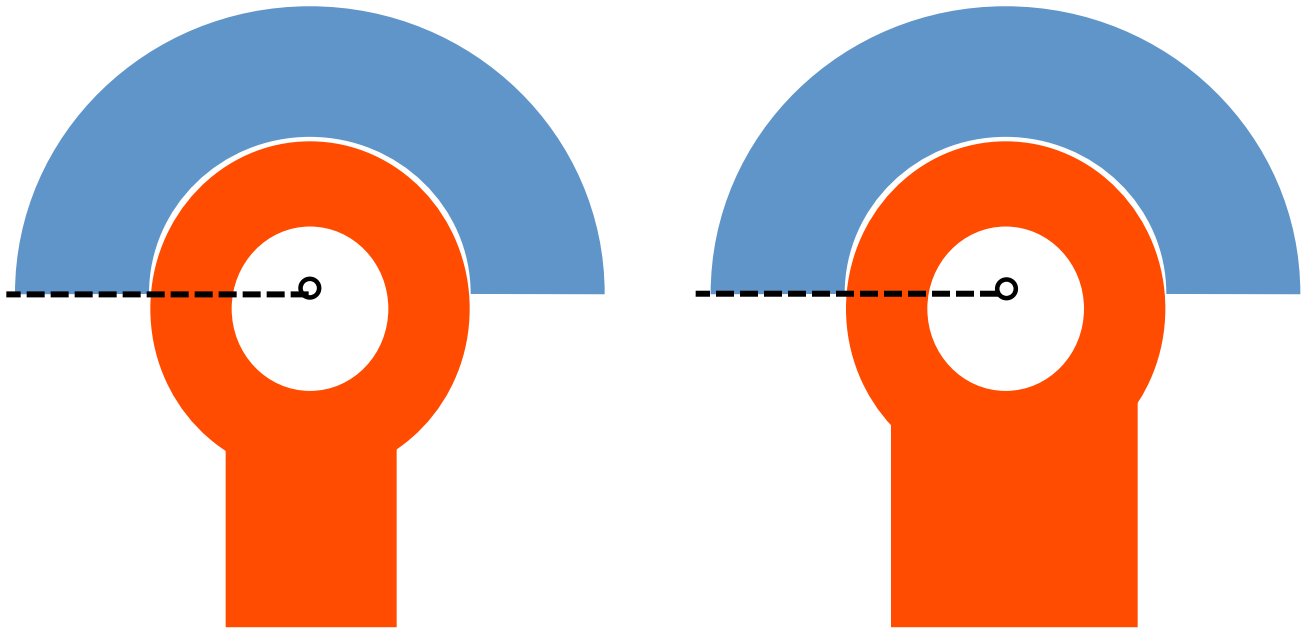

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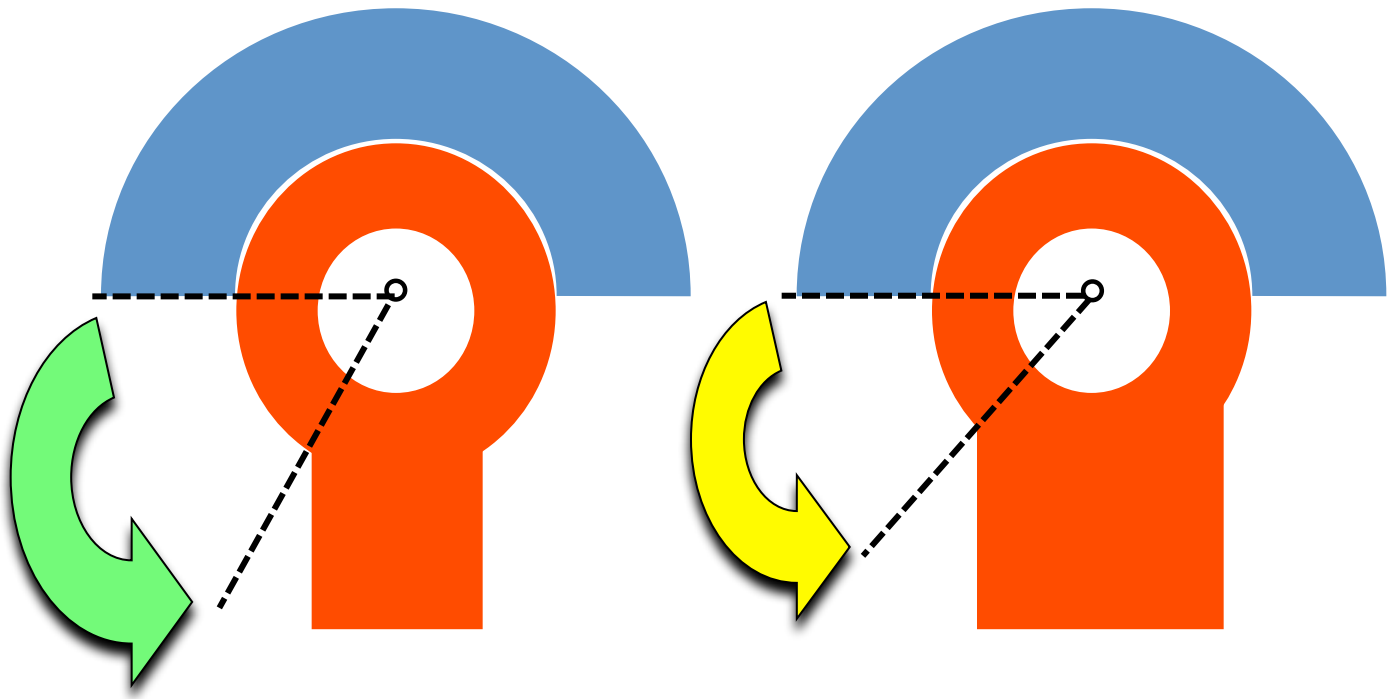


Large diameter heads

Head/neck relationship:

ROM is higher when the relationship head/neck is positive:

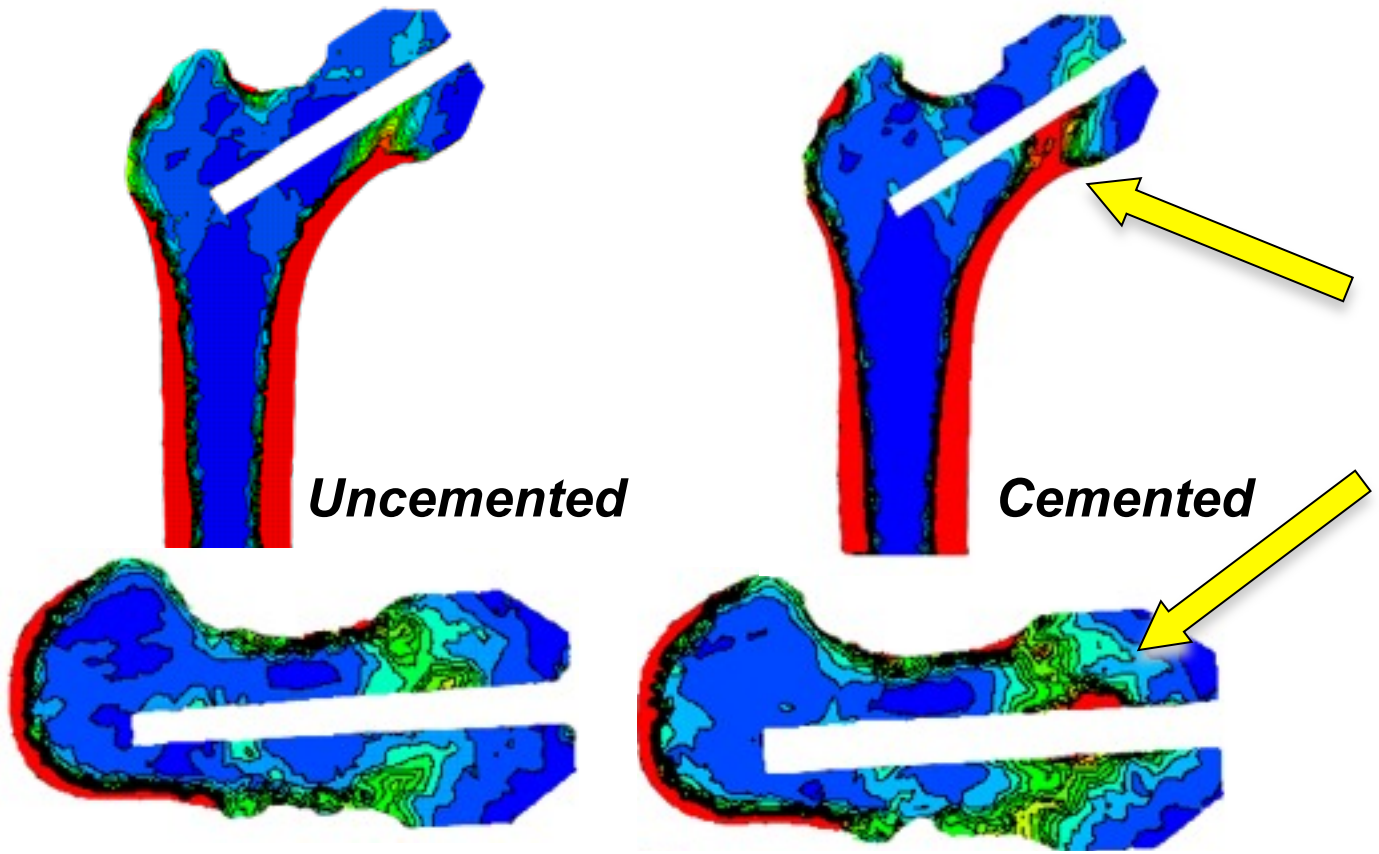
Big head ⇨ high ROM

Head adjusted to neck limits reduces ROM

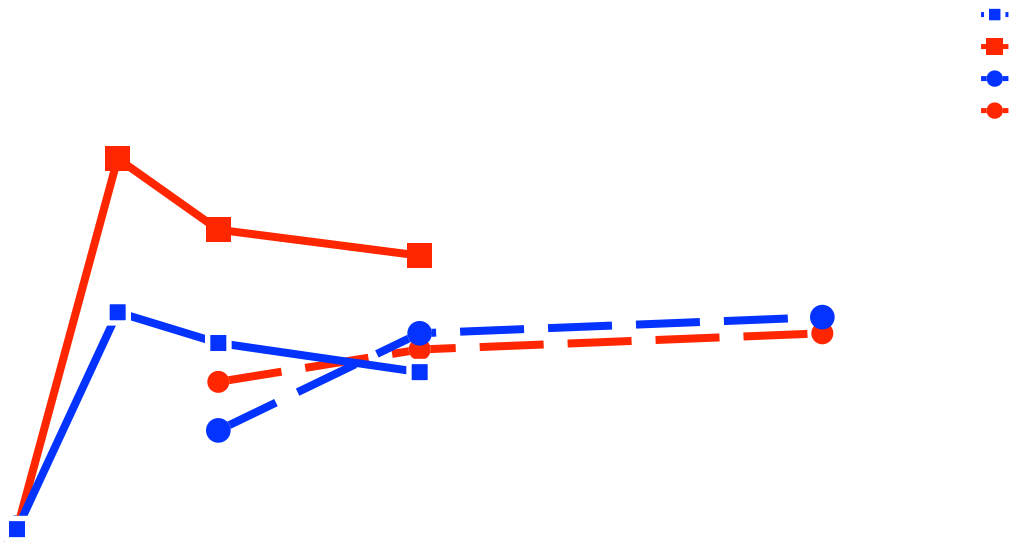
"Coxa protrusa" effect

Cement layer & stress shielding

- Distribution of charges in proximal femur after resurfacing are quite similar to those observed on a normal femur
- Stem osseintegration or cementation is not advised



Metal-on-Metal ion release



- Diameter 50: Skipor et al., EORS 2002, p. 187
- Diameter 28: Rodriguez et al., Tribology Meeting, Brussels, 2002.

Resurfacing disadvantages

- Large surgical approach
  - 30-40cm
- Long learning courve
- Difficult surgical technique
- Starting, high time of surgery
- Short clinical/radiological follow-up

Patient selection criteria

- Fit and active patients
- ♀ < 50 years
  - Hormonal changes?
- ♂ < 65 years

- Primary osteoarthritis
- Postraumatic osteoarthritis
- Normal to valgus CCD angle
- Sufficent bone stock
- Avascular necrosis of femoral head (<50%)

Resurfacing relative indications

- Deformed proximal femur
- Hip arthritis with femoral internal fixation
- Secondary small deformities
  - Small epiphyseal dysplasia's
    - NOT in varus
  - Slipped capital epiphysis
  - Perthes disease sequelleae

Resurfacing relative contraindications

- Coxa vara
- Acetabular protrusio
- Bone loss on femoral head
  - Voluminous cysts
  - Large osteonecrosis
- Non compliance of the patient
  - toxic abuses
- Known allergy of alloy constituents (CrCoNi)
- Very young women
  - Pregnancy & ions potential teratogenicity

Resurfacing contraindications

- Infection
- Rheumatoid arthritis
- Very stiff hip (“old” arthritic hip)
- Poor bone quality
  - Patients under chemotherapy
  - Patients under corticotherapy
  - Insufficient bone stock
  - Osteoporotic/elderly bone
  - Systematic renal failure

    (renal clearance of metallic ions)

LDH indications

- Bone loss on femoral head
  - Voluminous cysts
  - Large avascular necrosis (>50%)
- Non compliance of the patient
  - toxic abuses
- Severe neurologic patients
- Rheumatoid arthritis
- Very stiff hip (“old” arthritic hip)
- Poor cervical bone quality

Indications

DUROM Resurfacing	DUROM LDH

▪ Primary osteoarthritis
▪ Secondary osteoarthritis with small deformities NOT in varus
  ▪ Post traumatic
  ▪ Small epiphyseal dysplasia's
  ▪ Slipped capital epiphysis
  ▪ Perthes disease sequelleae
▪ Avascular necrosis of the femoral head (if remaining bone stock is adequate)
▪ Patients with femoral internal
	▪ Bone loss on femoral head
	  ▪ Voluminous cysts
	  ▪ Large osteonecrosis
	▪ Not compliance of the patient
	  ▪ toxic abuses / drug addiction
	▪ Severe neurologic patients
	▪ Very stiff hip (“old” arthritic hip)
	▪ Poor cervical bone quality
	▪ Severe rheumatoid arthritis
	▪ Chemotherapy/

Resurfacing preoperative planning

- Determine approximative dimension
  - Acetabulum
  - Femoral head
- Localize bone loss areas
- Look for potential difficulties
- Verify ideal stem axis
- Final prosthetic size:

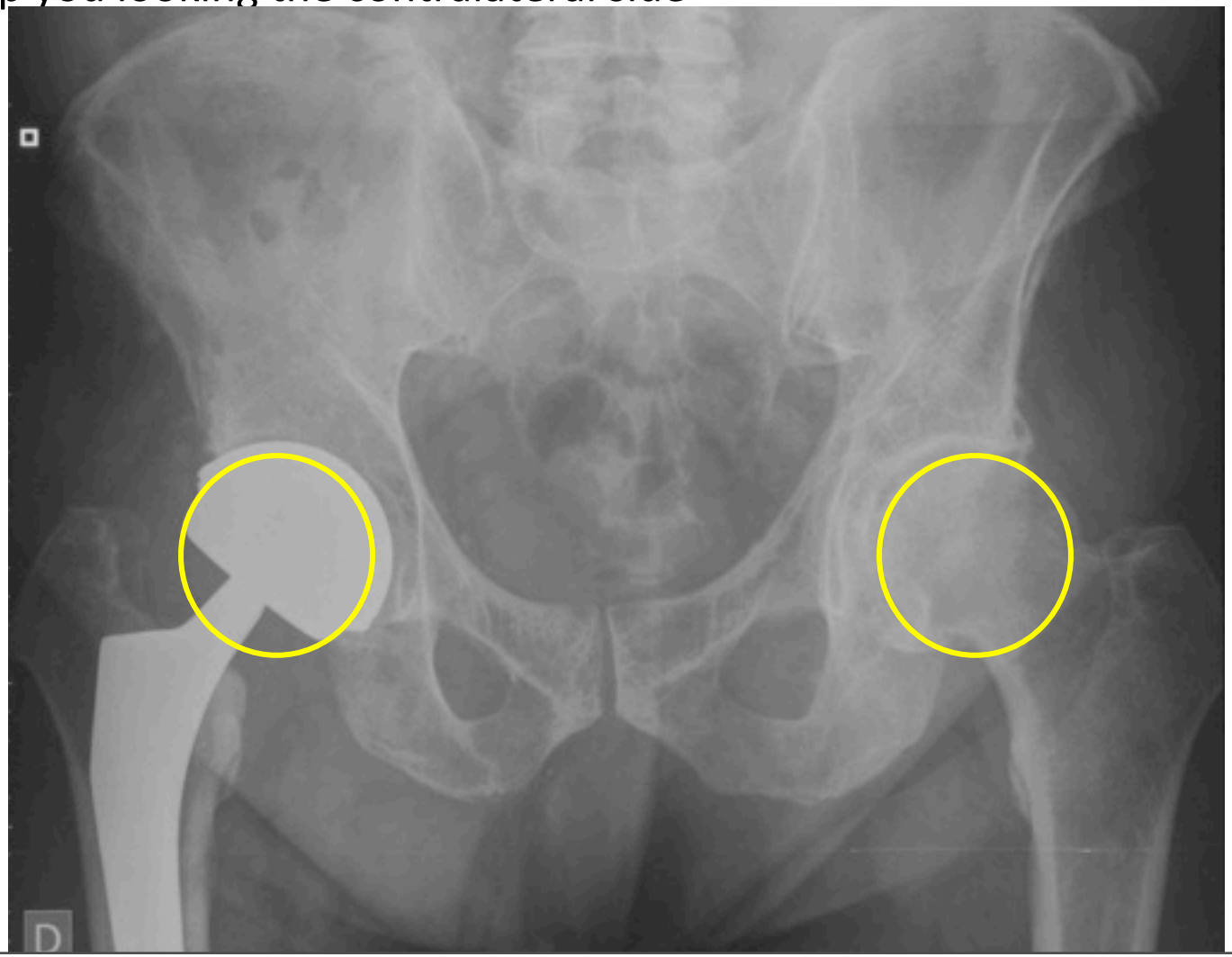
intraoperative !

Resurfacing preoperative planning

- Calculate the “original” size of the femoral head and acetabulum
  - Help you looking the contralateral side

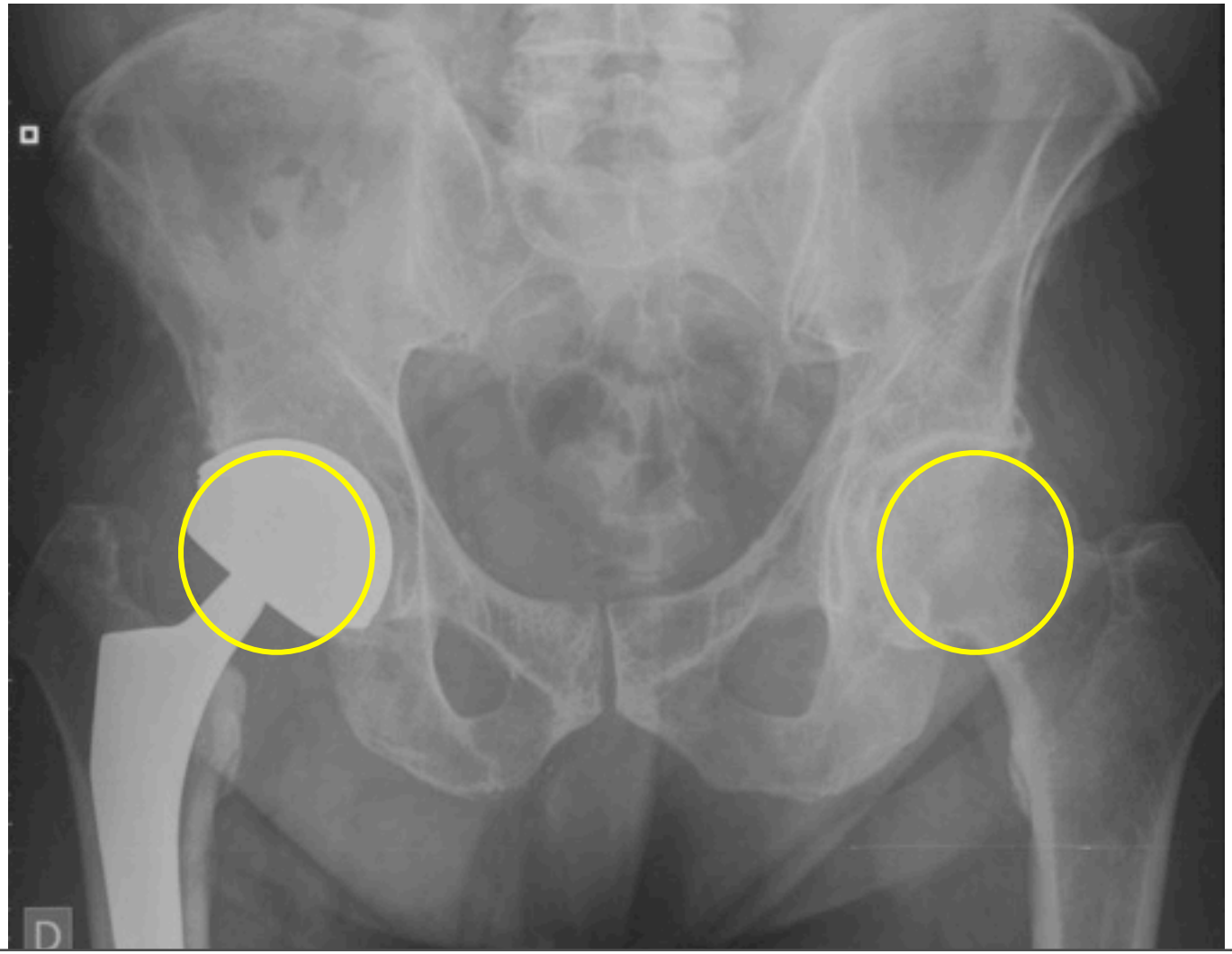
Resurfacing preoperative planning

- Calculate the “original” size of the femoral head and acetabulum
  - Help you looking the contralateral side



Resurfacing preoperative planning

- Respect rotational hip acetabular center
  - Avoid medialisation



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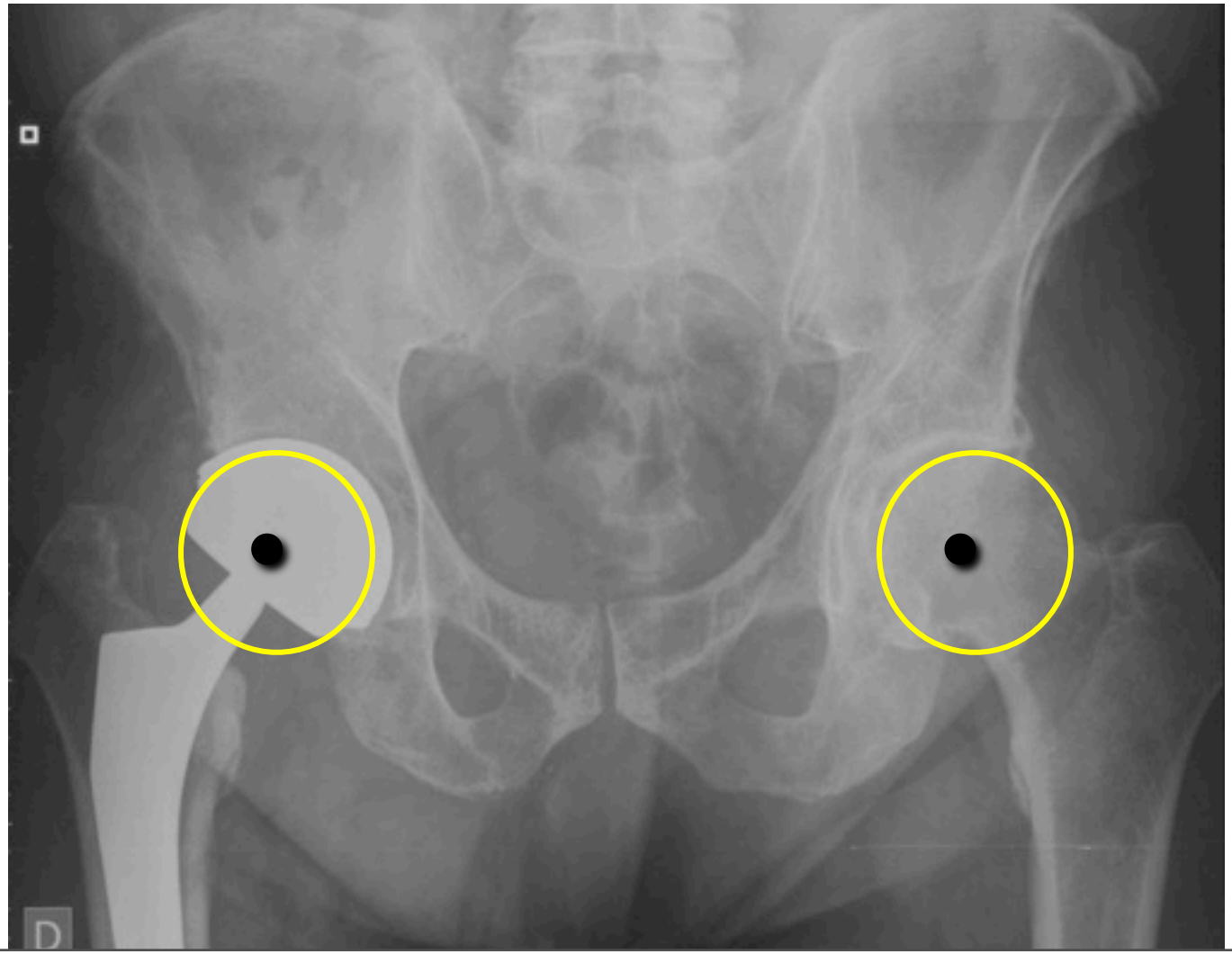
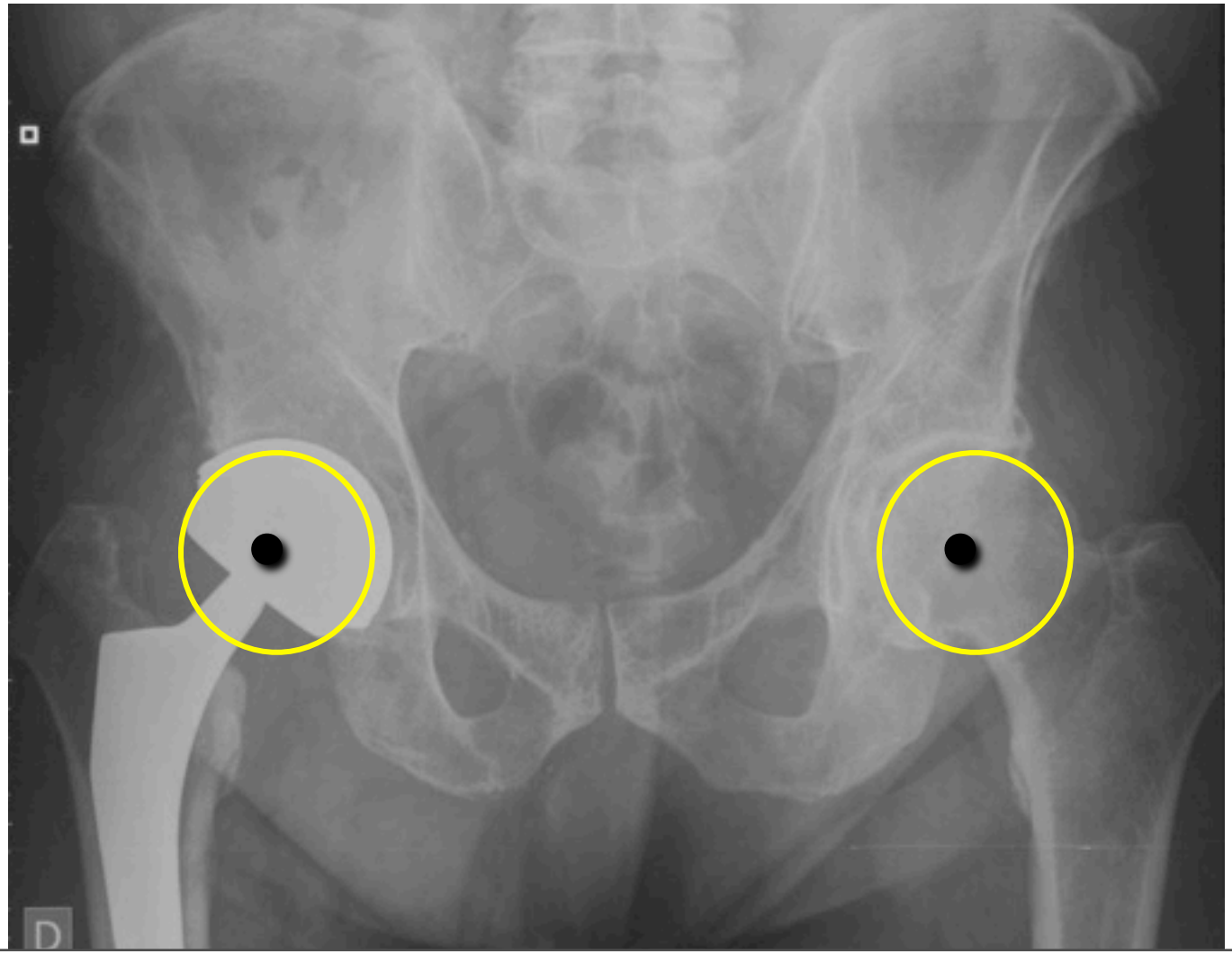


Resurfacing preoperative planning

- Note inclination angle of the cup to be placed
  - 40°-50° inclination
  - Natural (10°-20°) anteversion



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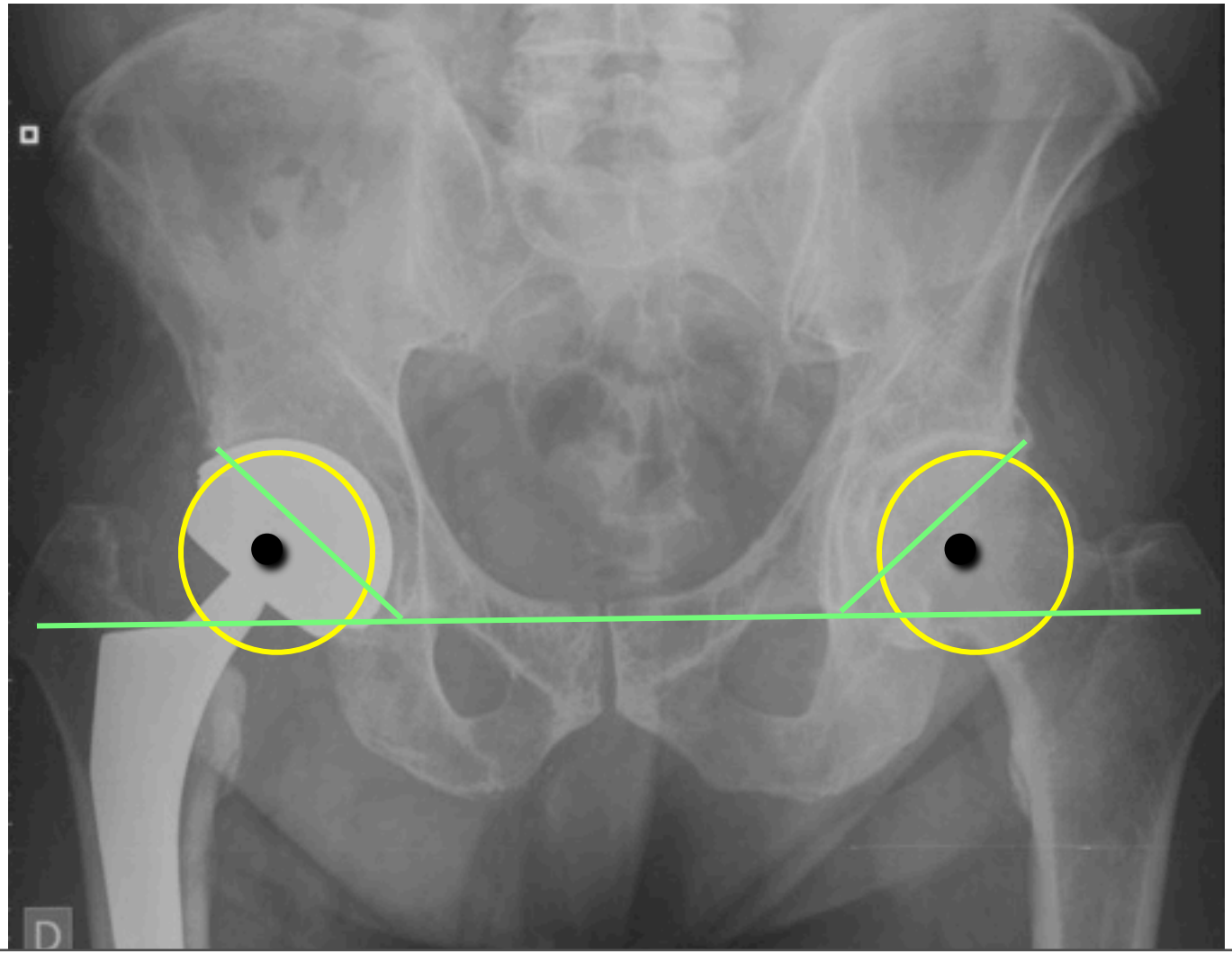

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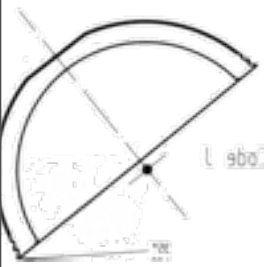
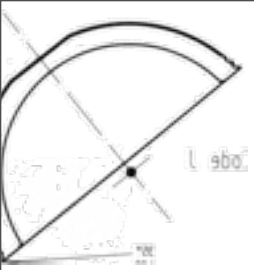


Resurfacing preoperative planning



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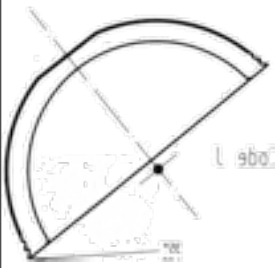

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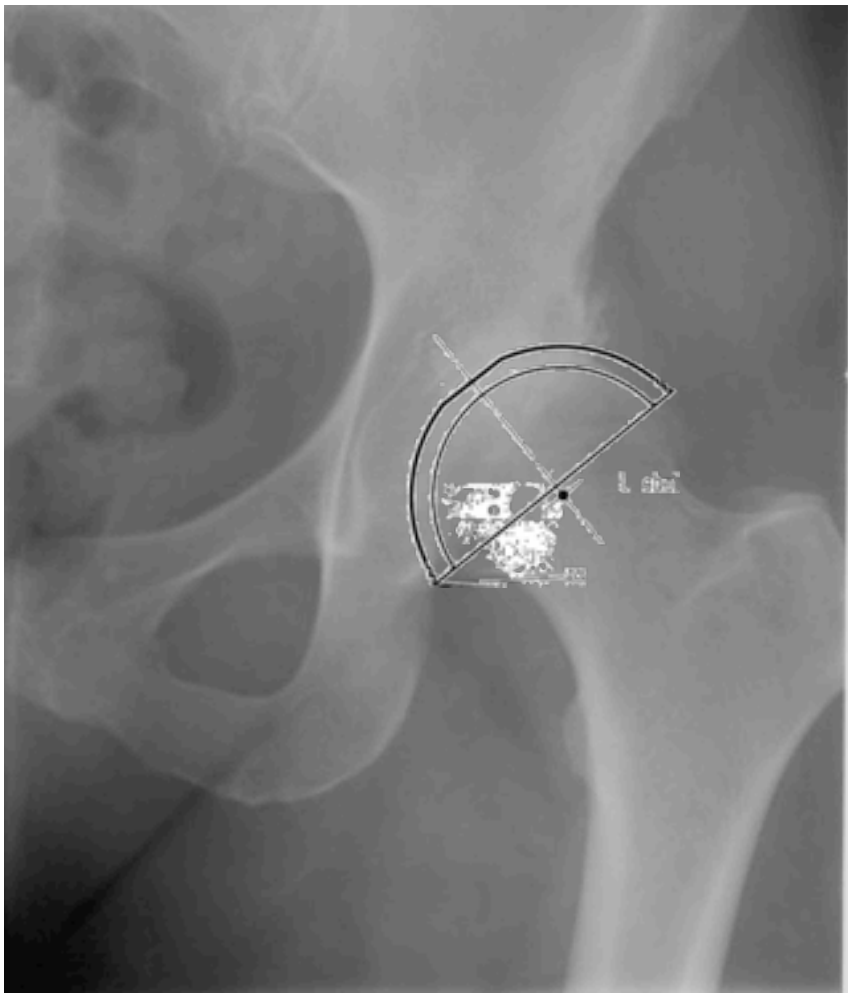

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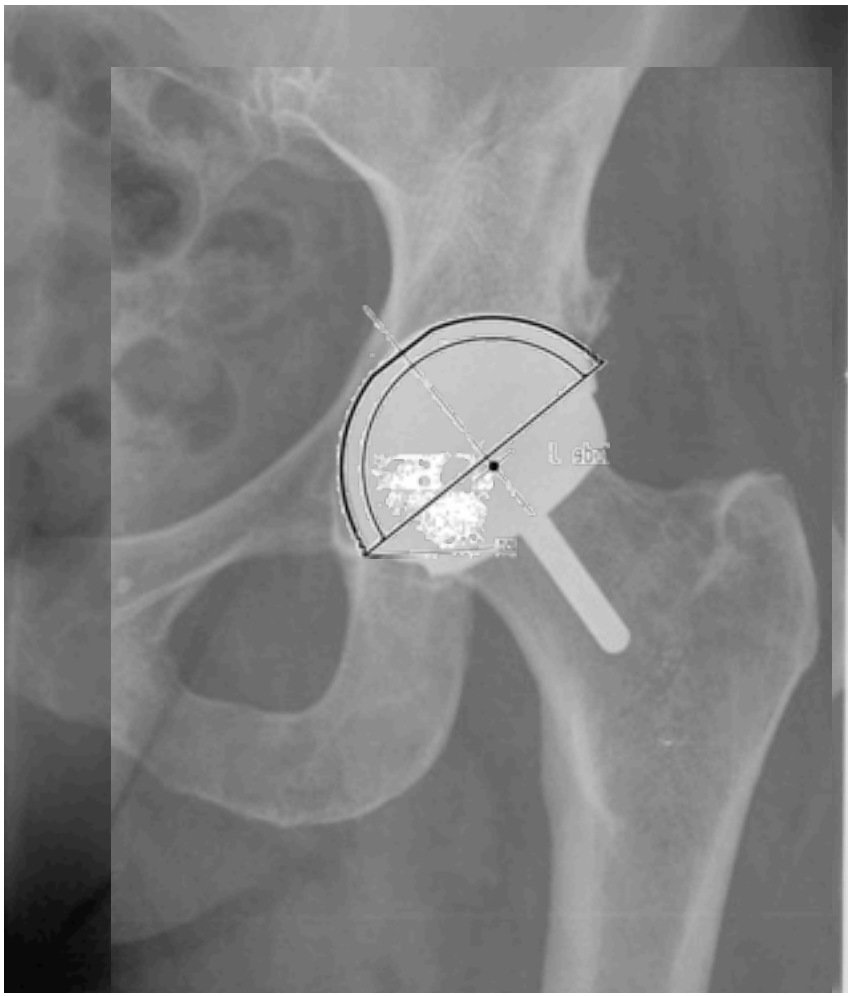


Resurfacing preoperative planning

- Analyze osteophytes to be resected…

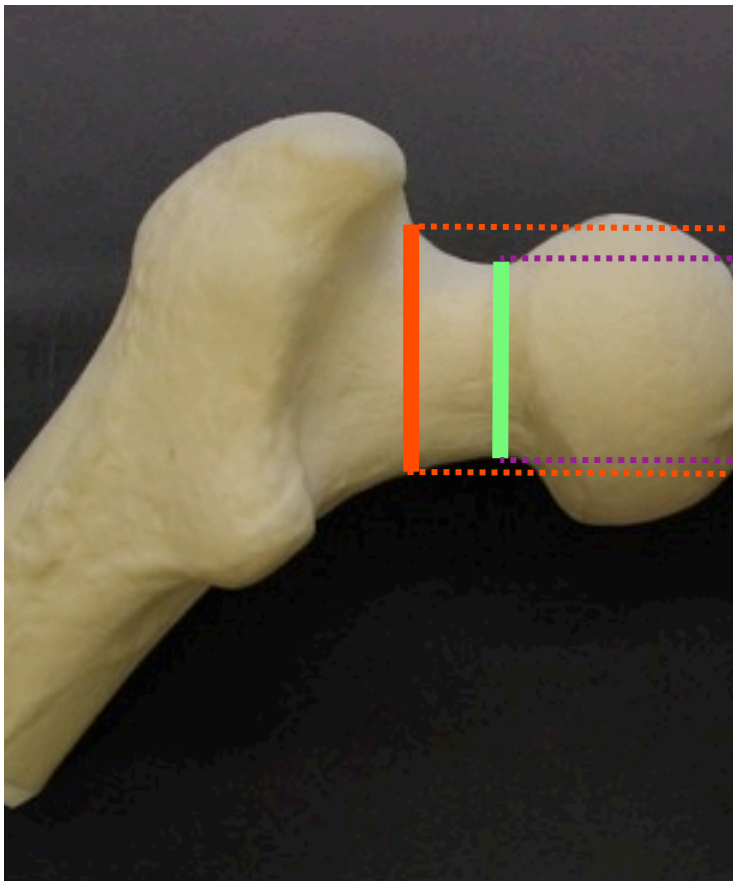
  …before hip dislocation if possible

- Consider bone cysts to resect & graft

  Zone I cysts….. Danger of loosening!!

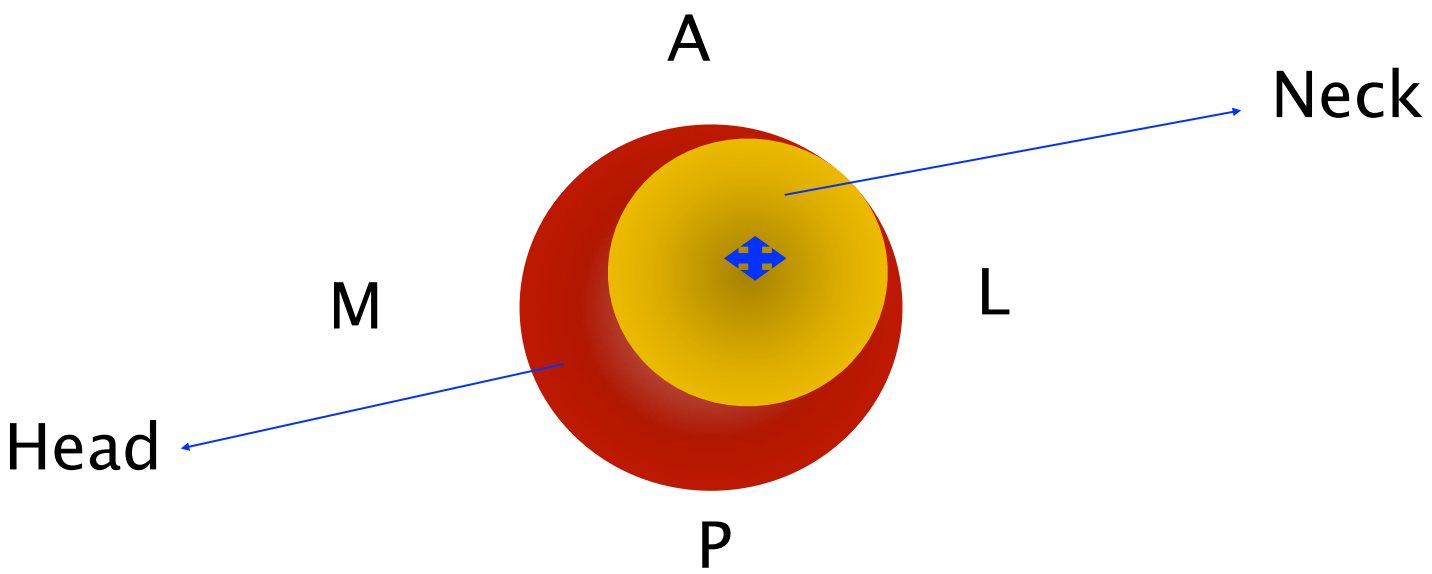
Checking for femoral size

- Osteophyte resection
- Determine the smaller diameter of the neck
  - Subcapital
  - Craneo-caudal
- Determine the largest diameter on the basis of the neck
- Final femoral size cup is between the 2 lines



Finding neck axis…

- Center the implant on the ***femoral neck*** and *not on the femoral head*
- Centering over the femoral head may produce
  - Notching of the femoral neck
  - Varus positioning of the rood



Finding neck axis…

- Preoperative planning of entry point of the axis over the surface
  - Superior
  - Lateral
  - Posterior

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  - Superior
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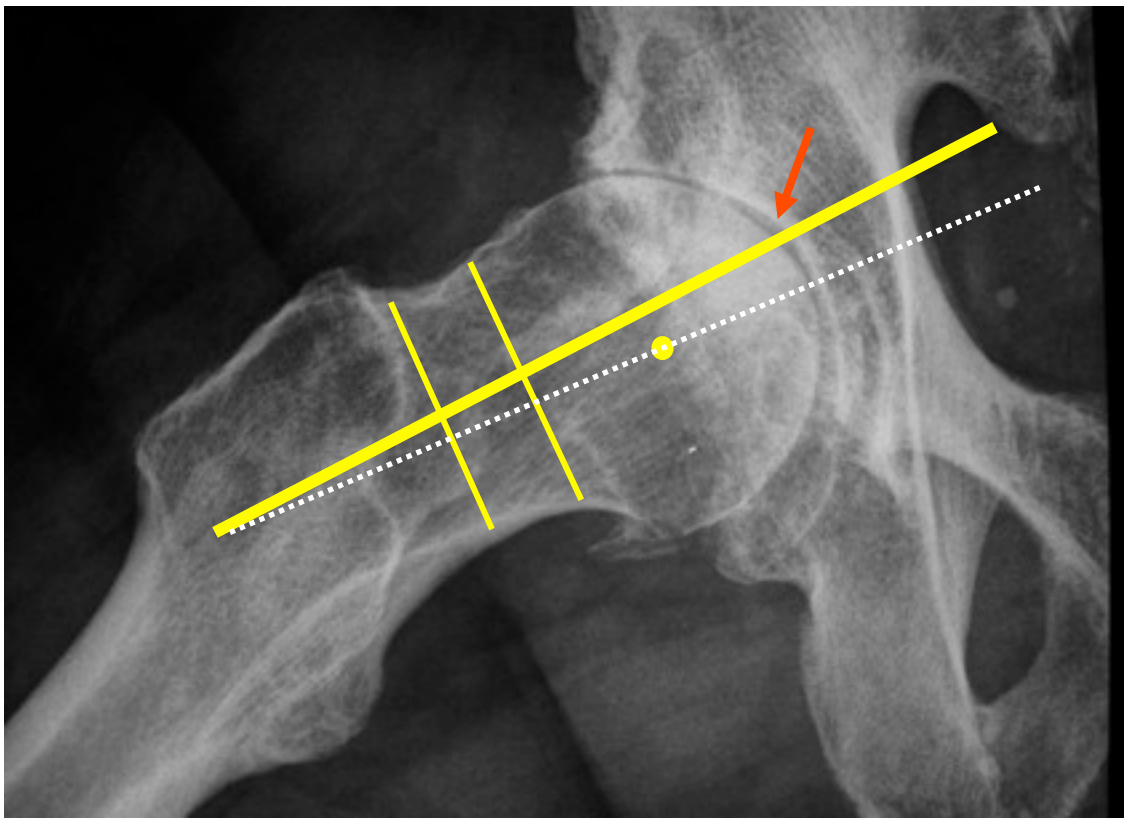

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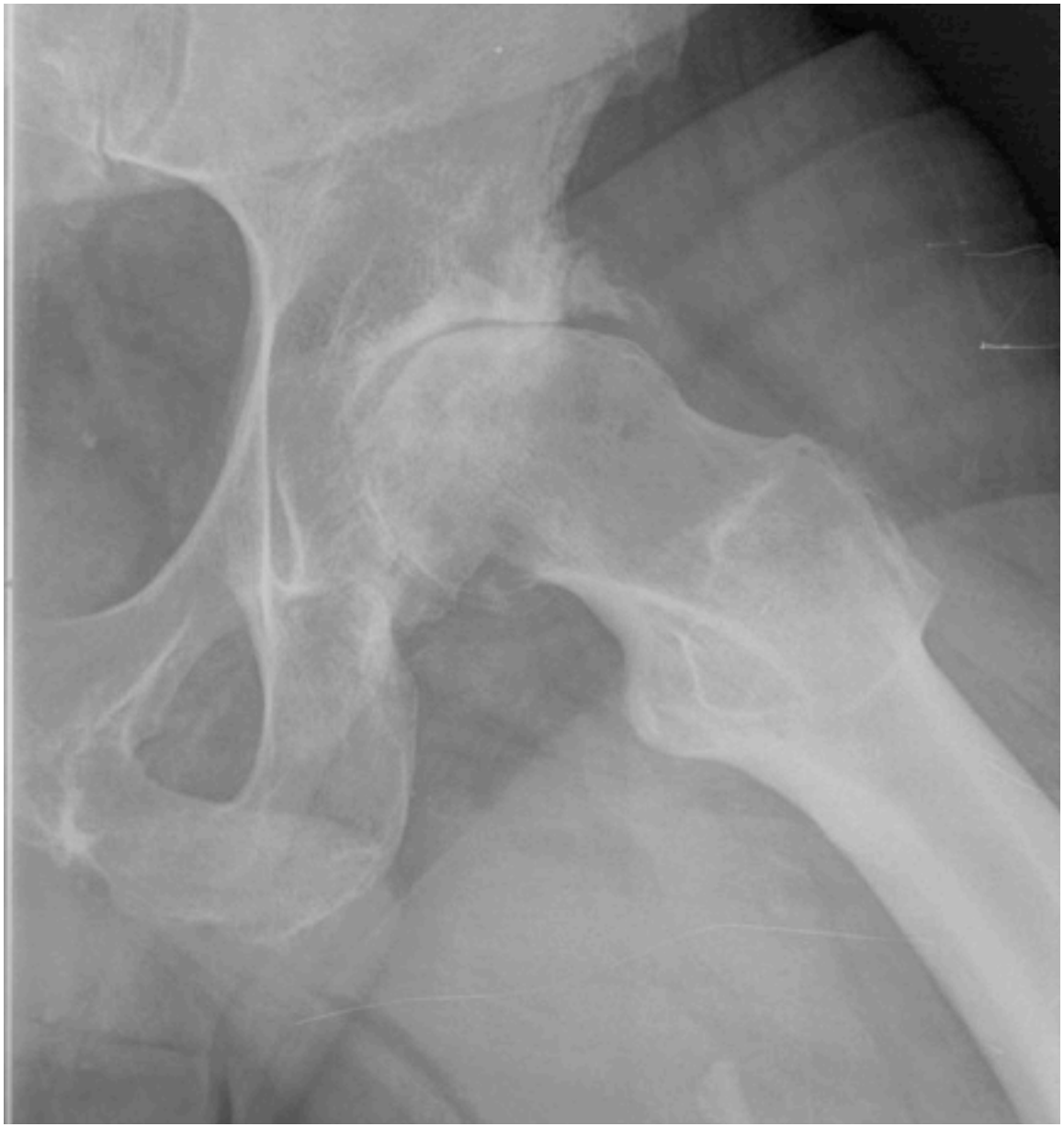

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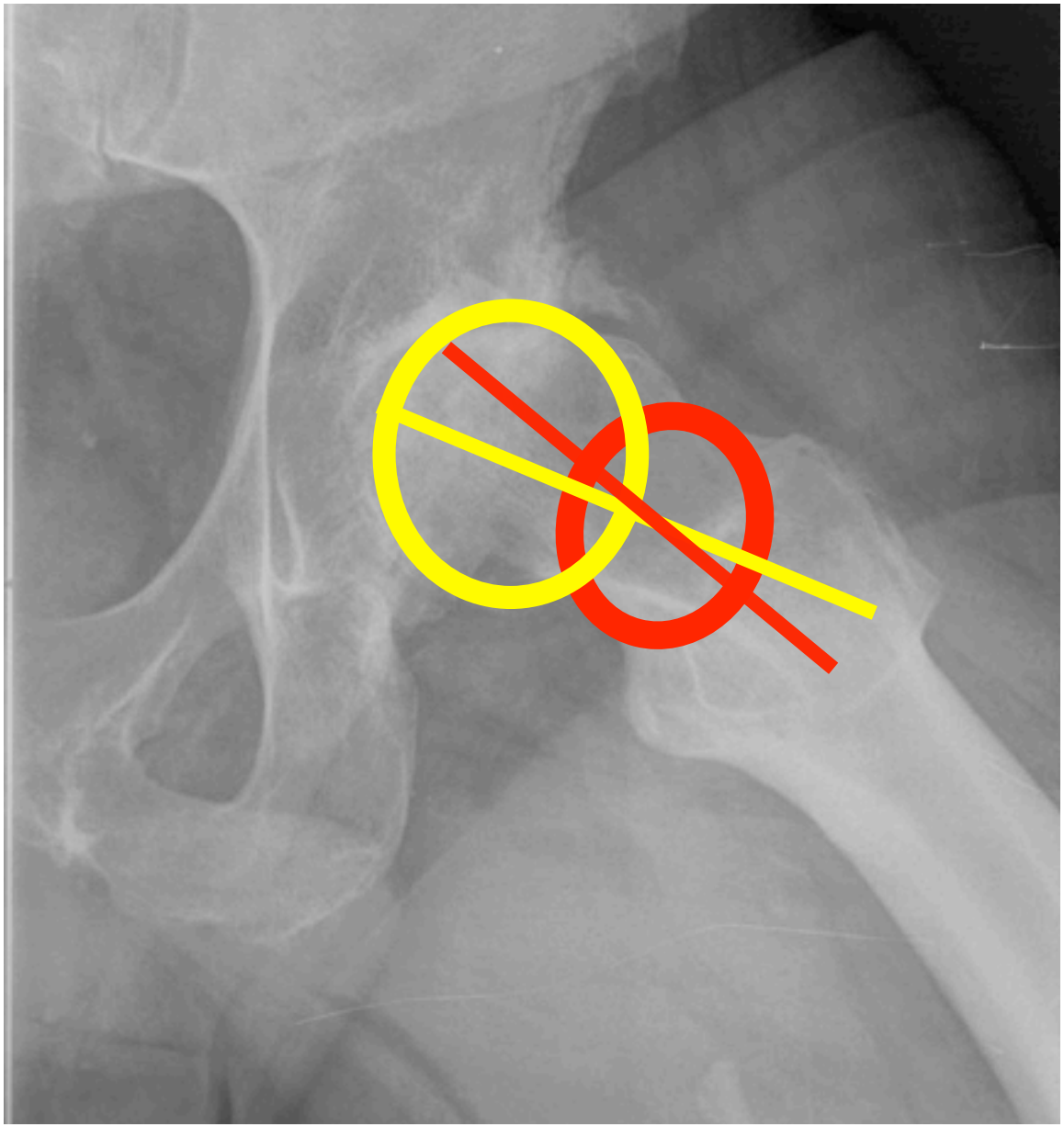

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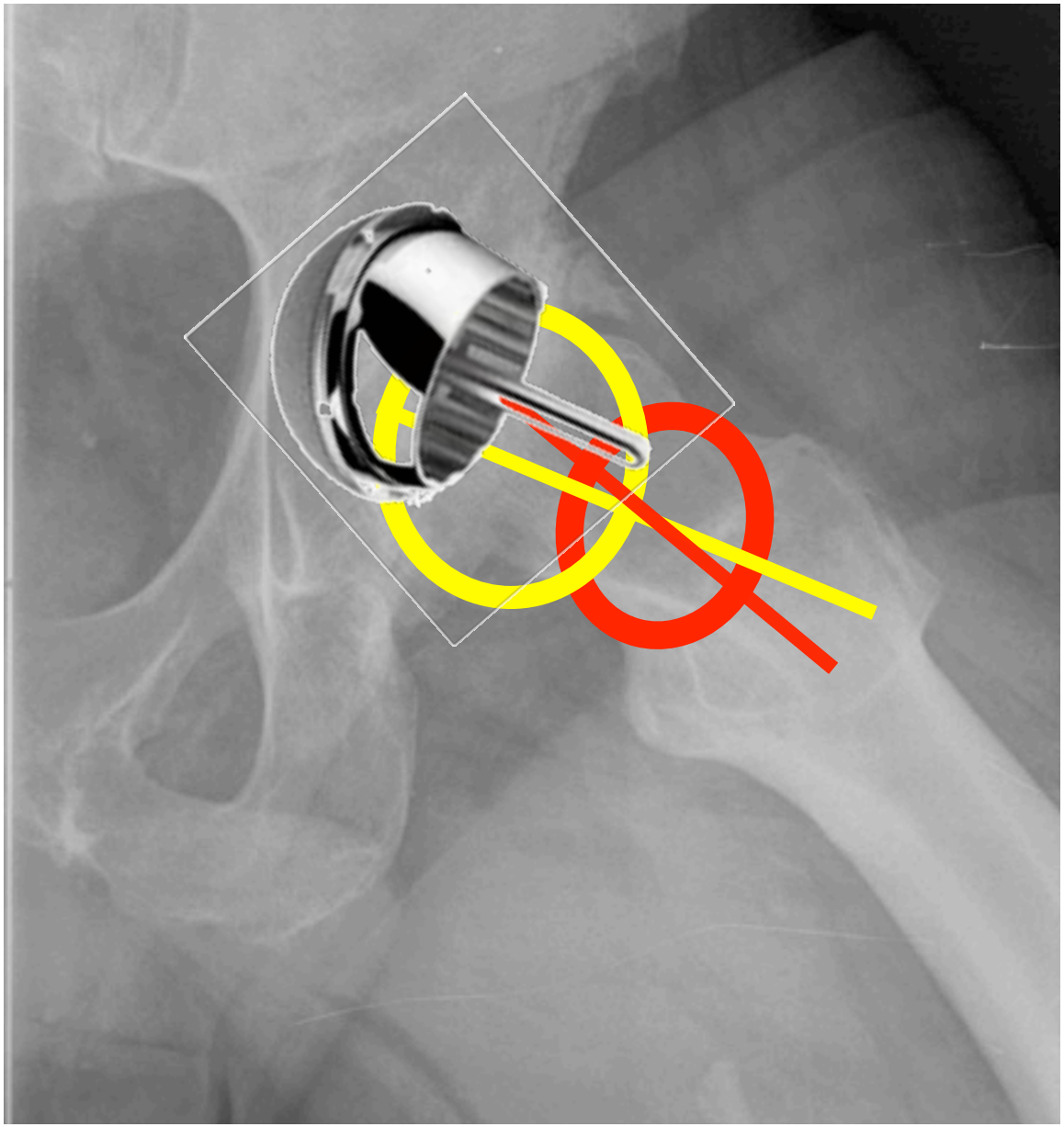

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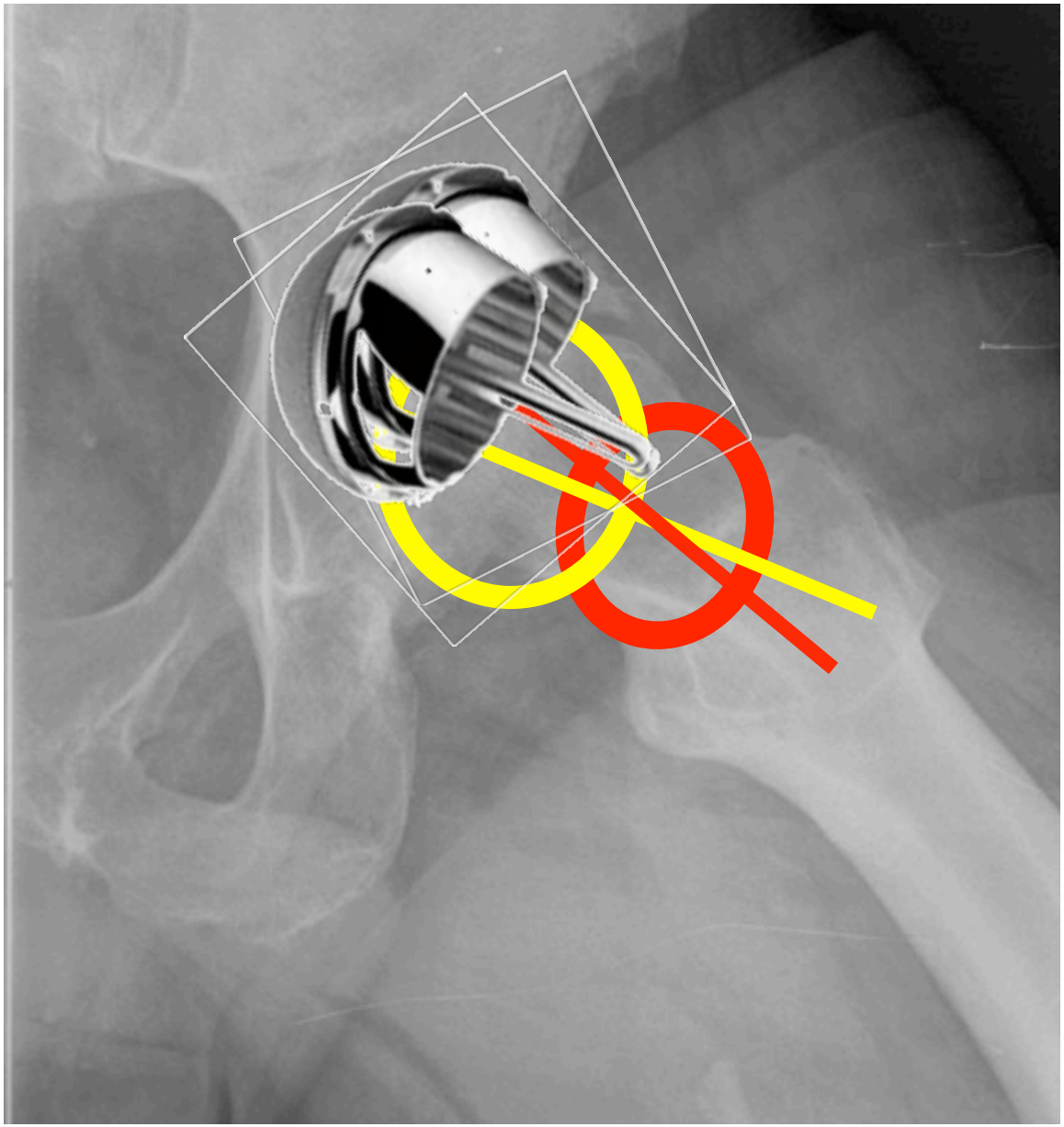
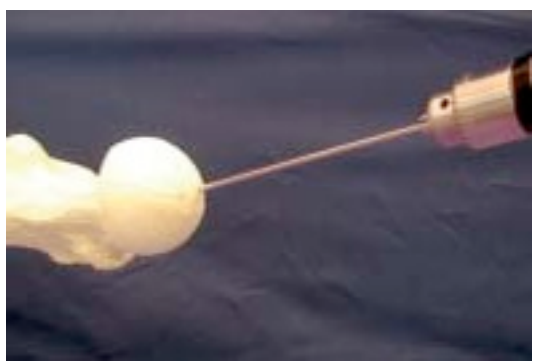


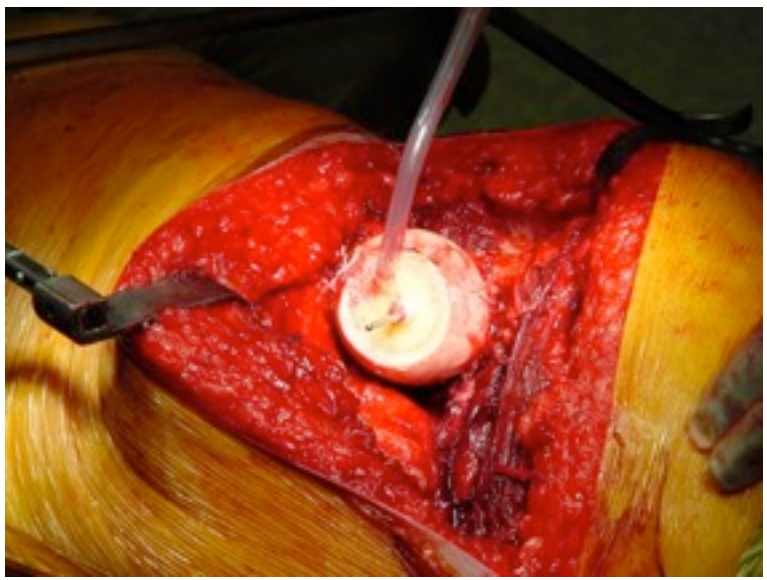
Finding neck axis…

- Provisional rood
- Not on the center of the head
- Entrance in posterior-lateral position (wear region)



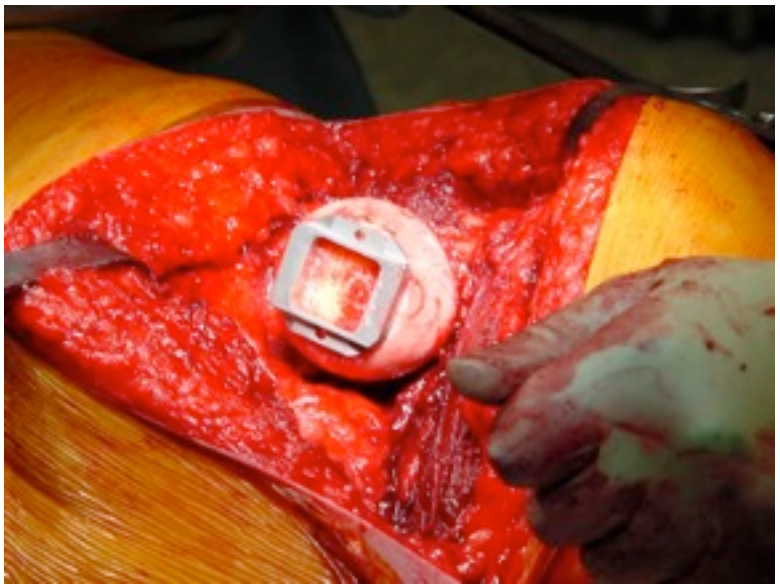
Finding neck axis…

- Prepare flat surface 15 x 15 mm with reamer



Finding neck axis…

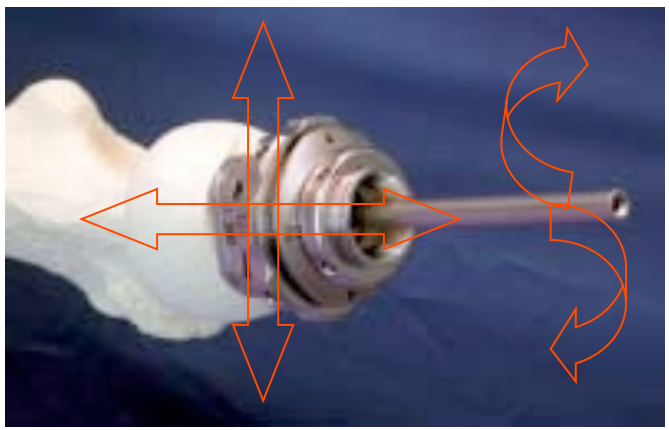
- 2 base plate dimensions
  - 25 mm
  - 30 mm
    - Over reaming produces hip medialization !!!

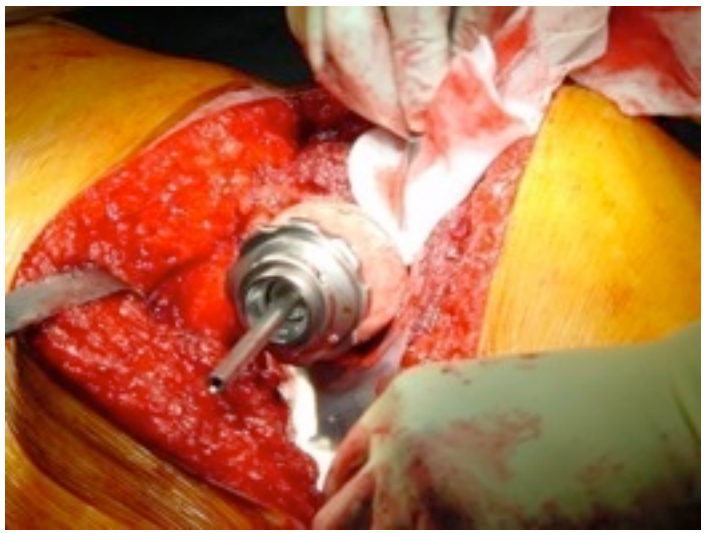


Finding neck axis…

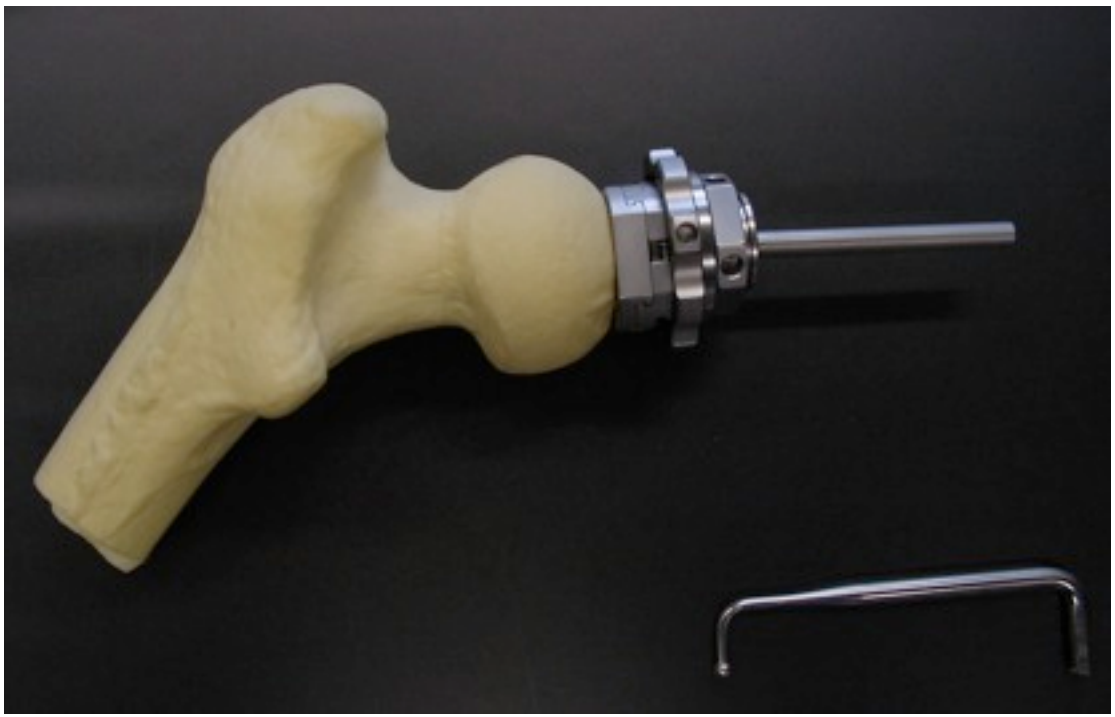
Placing the centering jig

- A – P positioning
- M – L positioning
- Inclination of the axis parallel to the inferior neck limit



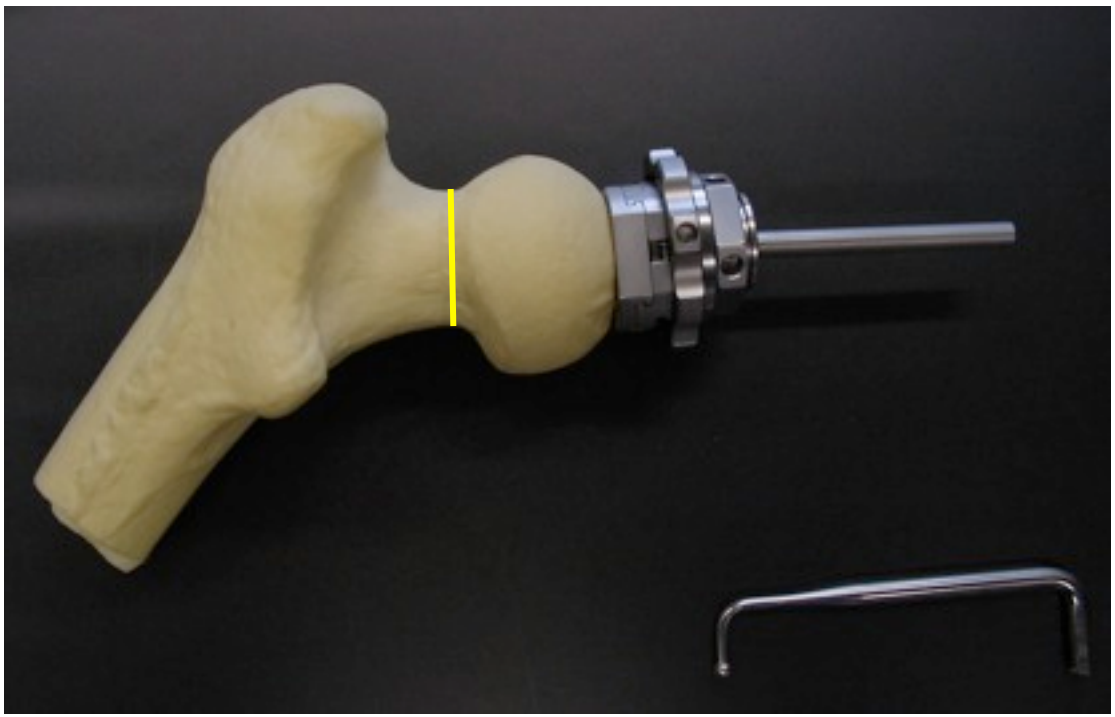


Checking neck axis…



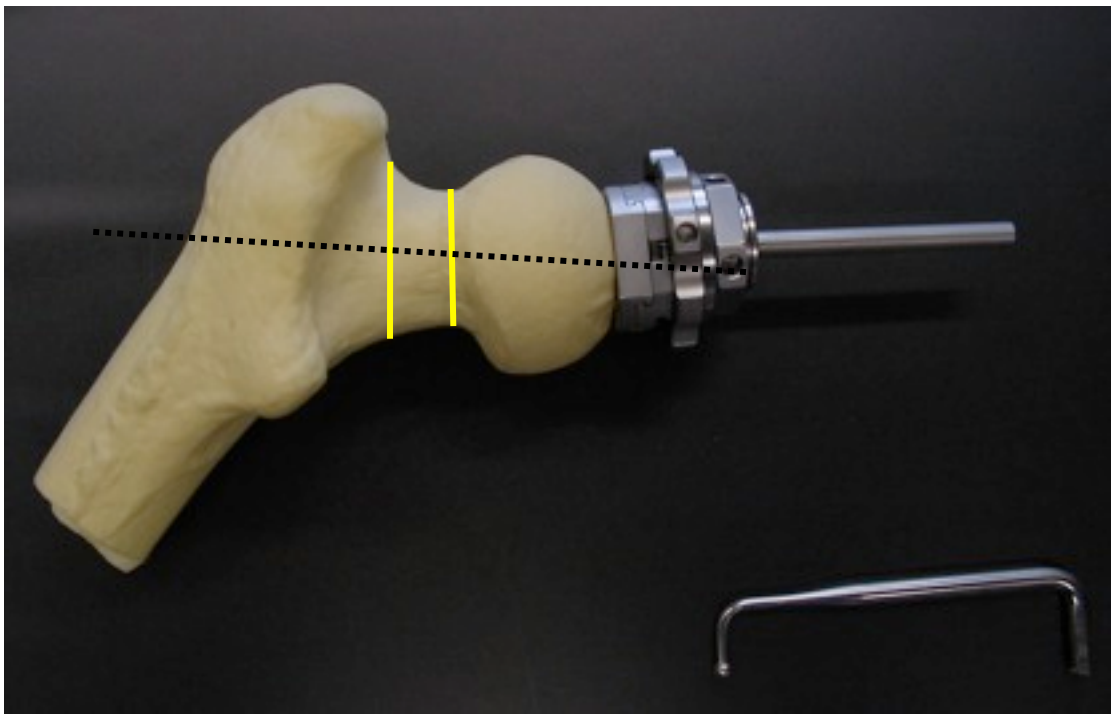
Checking neck axis…

- Check in subcapital area



Checking neck axis…

- Check in subcapital area
- Check in basicervical area too



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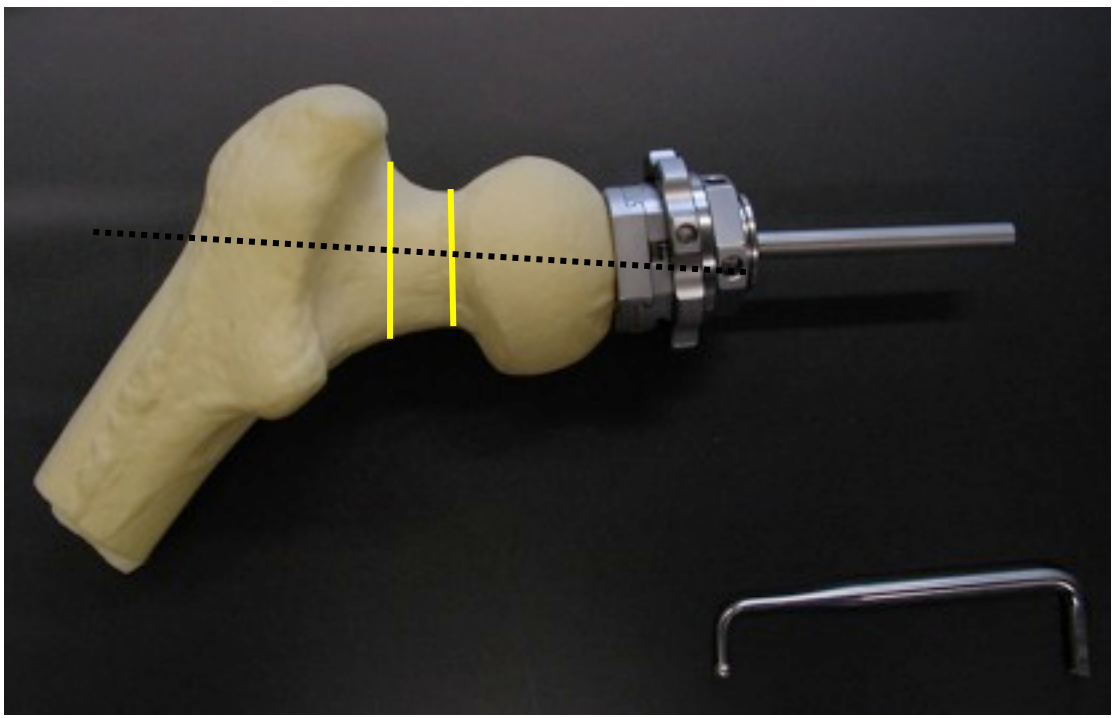
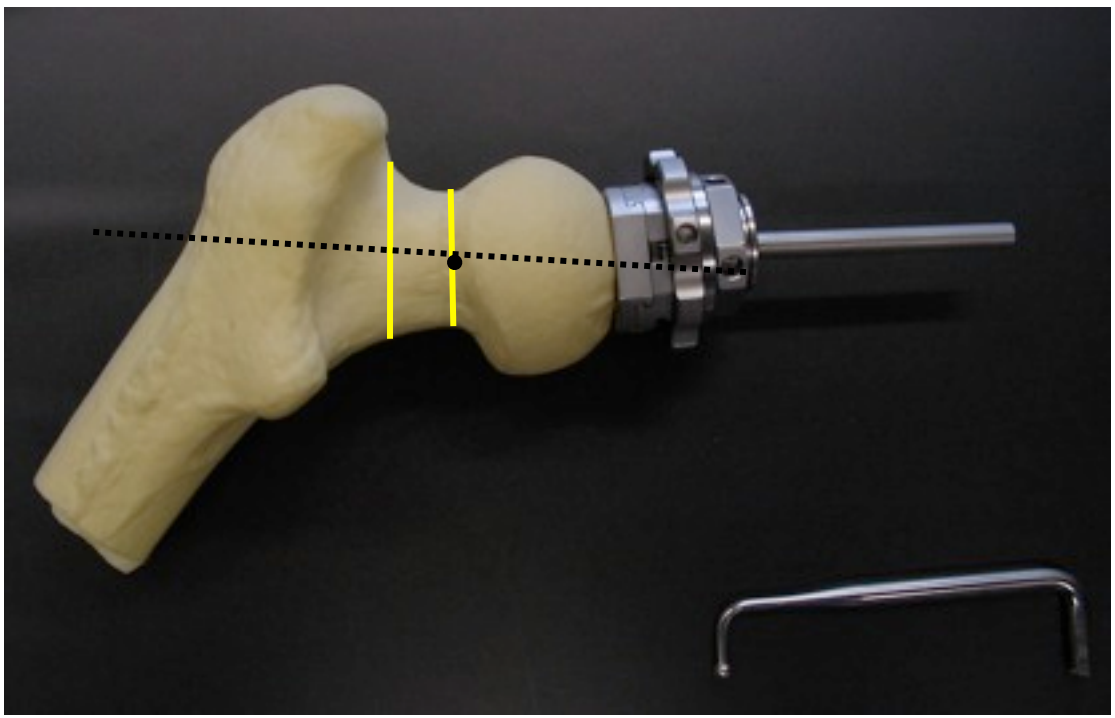


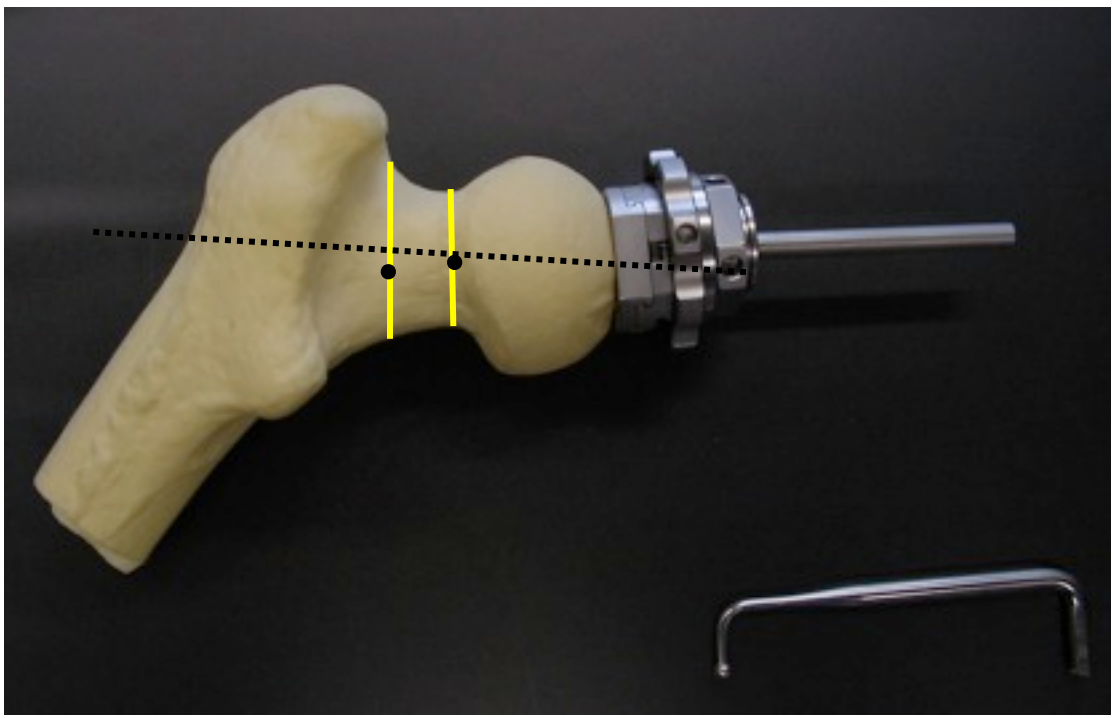
Checking neck axis…

- Determine the center of subcapital line



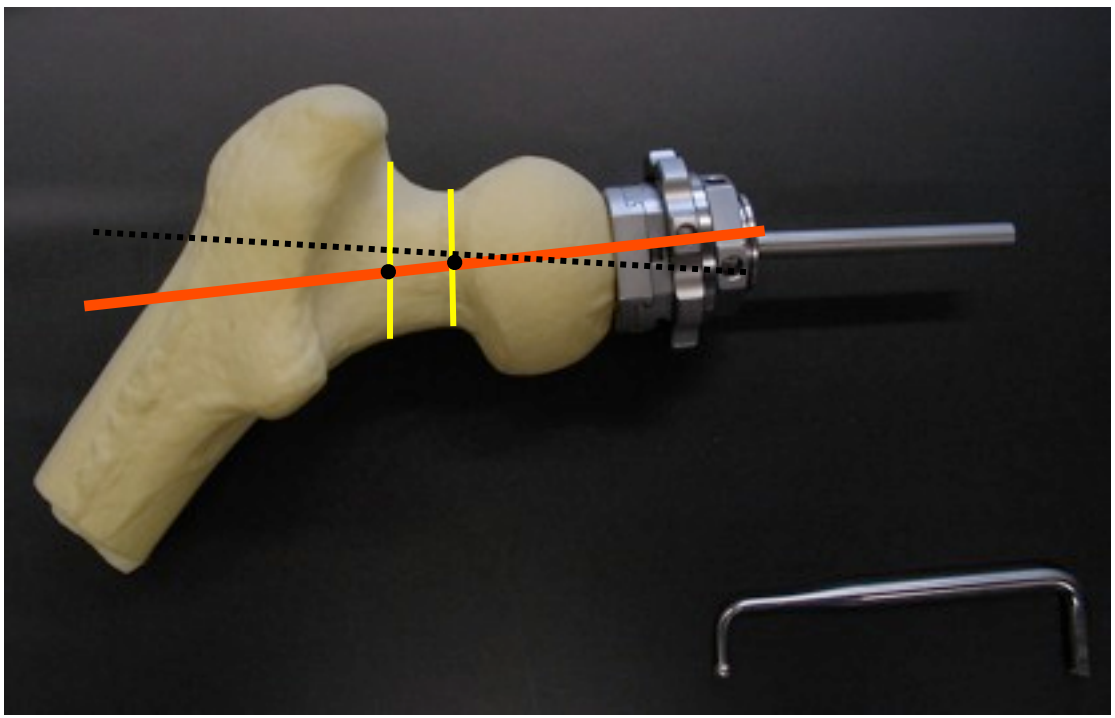
Checking neck axis…

- Determine the center of subcapital line
- Determine the inferior 1/3 of basicervical line



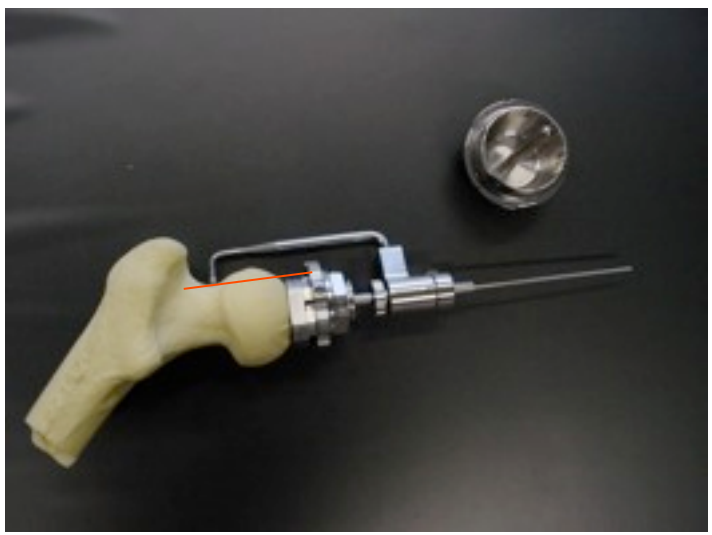
Checking neck axis…

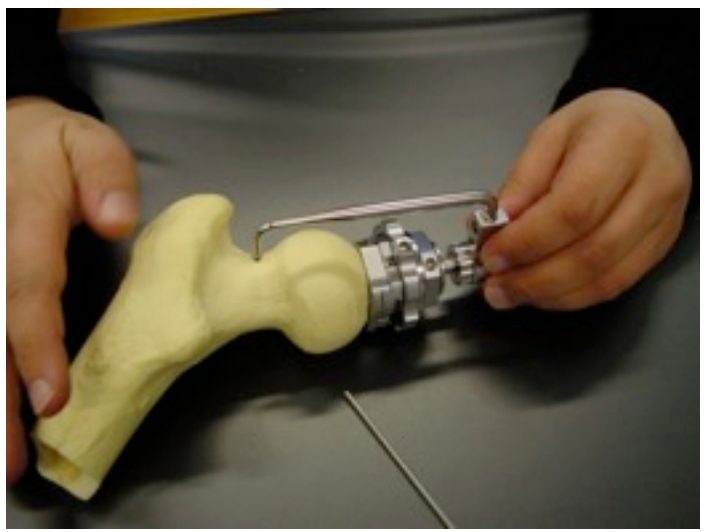
- Determine the center of subcapital line
- Determine the inferior 1/3 of basicervical line
- Correct axis should be located on the line crossing both points (slight valgus)



Checking the neck - Head dimension

- For determine the “smaller” head size
  - Check in subcapital area
  - Avoid sizes too close to the femoral neck
  - No notch in any plane





New centering jig

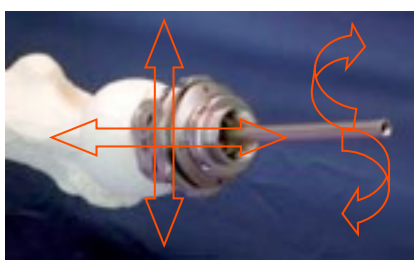
Based on cervical anatomic landmarks

- McMinn's surgical technique based
- Preoperative plan mandatory
- Less time consuming ?
- Reproducible ?
- More precision ?

- … not in my hands…

Navigation

- Easy to use
- IR based
- 100 points for morphing neck
- Automatic centering of axis wire
- Always possible to have manual control!
- >90 % security / reproducibility



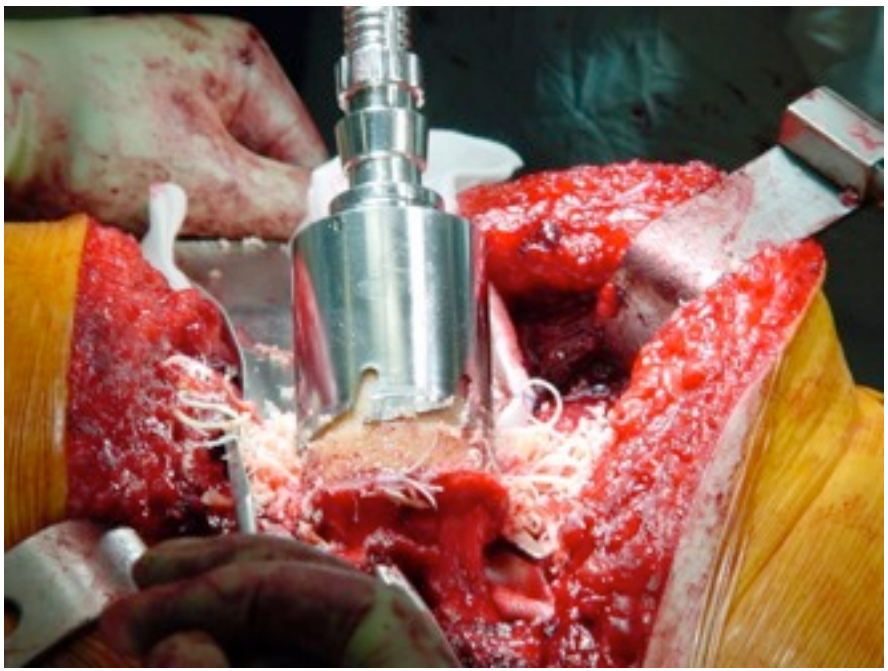
Preparing the head

- Insertion of definitive guide wire
- Drill the rood cervical canal
  - Intra-operative X-ray if you are doubts…



Reaming the head (cylinder cutters)

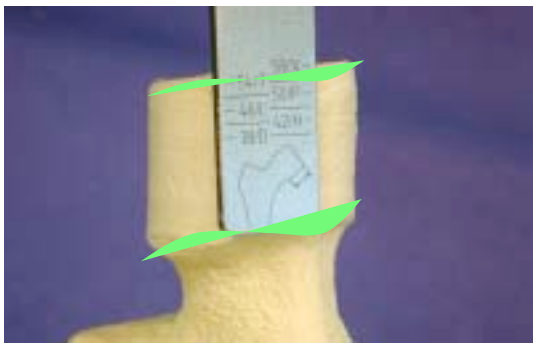
- Start with larger diameter
- Reducing diameter progressively until definitive head size

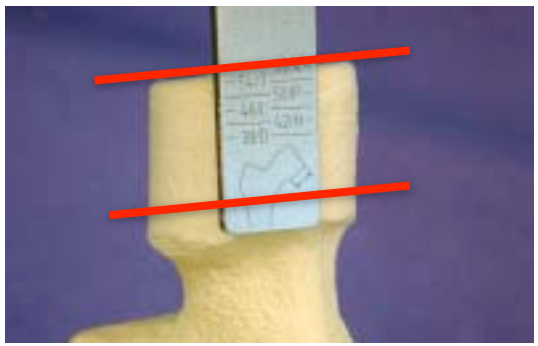


Preparing the head

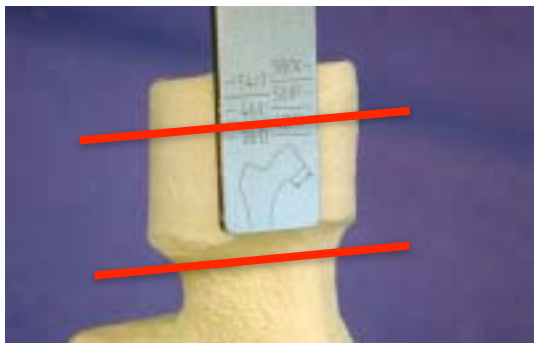
Final head polar resection

- Coverage of the cancellous bone of the head
  - “ideal” coverage of cancellous bone
  - Irregular S shape morphology
  - Cover cranial head/neck junction
  - Do “economic” resection





Risk of neck fracture

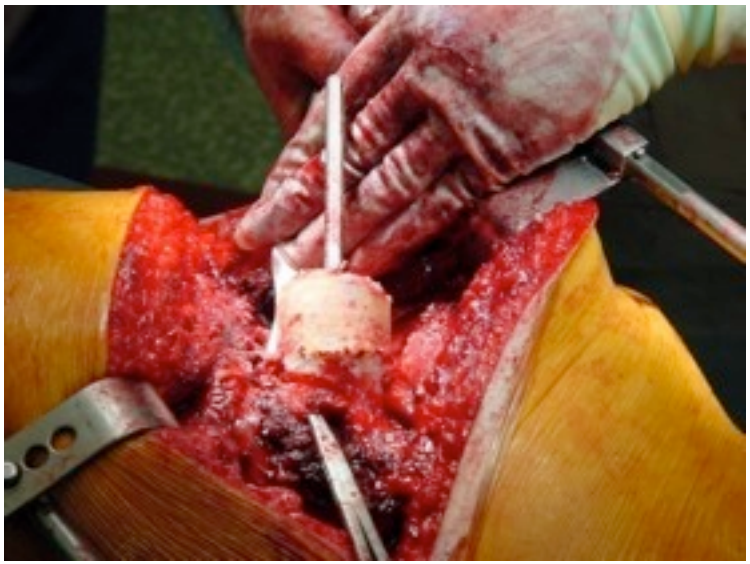


Excessive medialization

Preparing the head

Finishing the head…

- Chamfers
- Evaluation of bone loss defects (cement/graft)

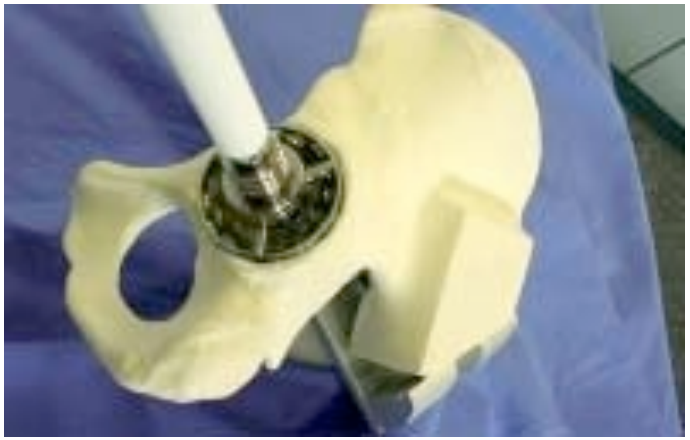


Implanting prosthetic head

- Perforate sclerotic bone 2 mm drill
- Pulsed high pressure cleaning
- Intramedullary aspiration
- Low viscosity cement (Simplex)
  - 4 minutes
  - Manual pressurization
  - No hammering
- Reduction

Acetabular preparation

- Sequential reaming
  - 2 mm
  - 1 mm if sclerotic bone
- Find adequate cancellous bone
- Respect acetabular walls!!
- Last reamer 6mm greather than cephalic size
- Acetabular implant is really 2mm bigger than the last reamer used

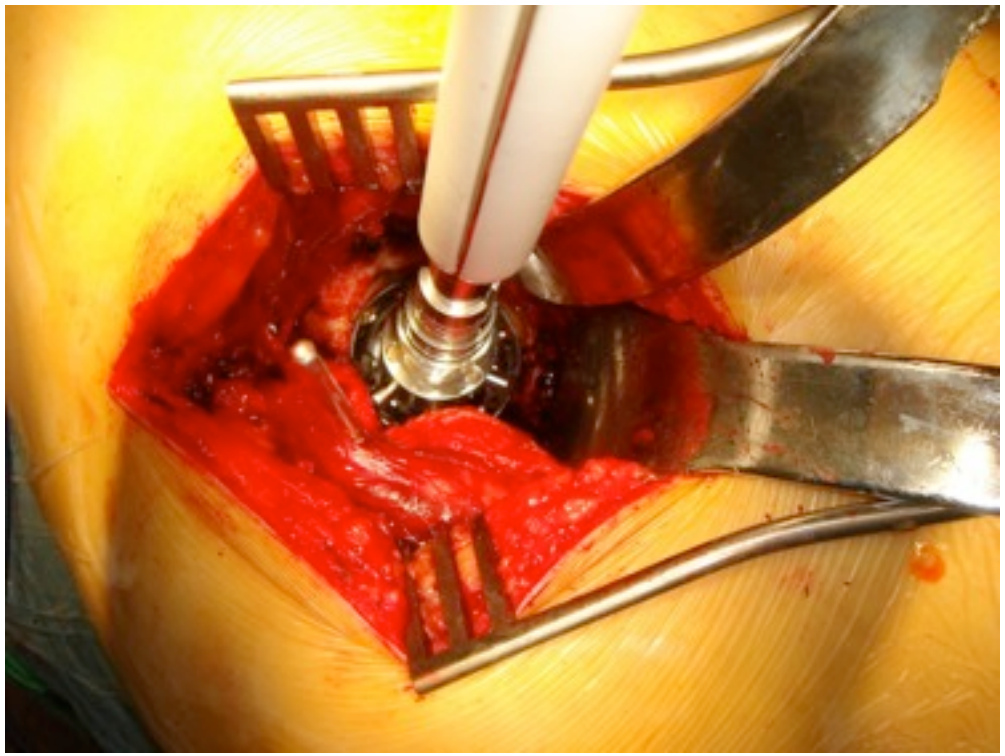


Acetabular preparation

- Analyze bone hardness or sclerosis when reaming
- Never forget that ø acetabular cup ≠ ø reamer

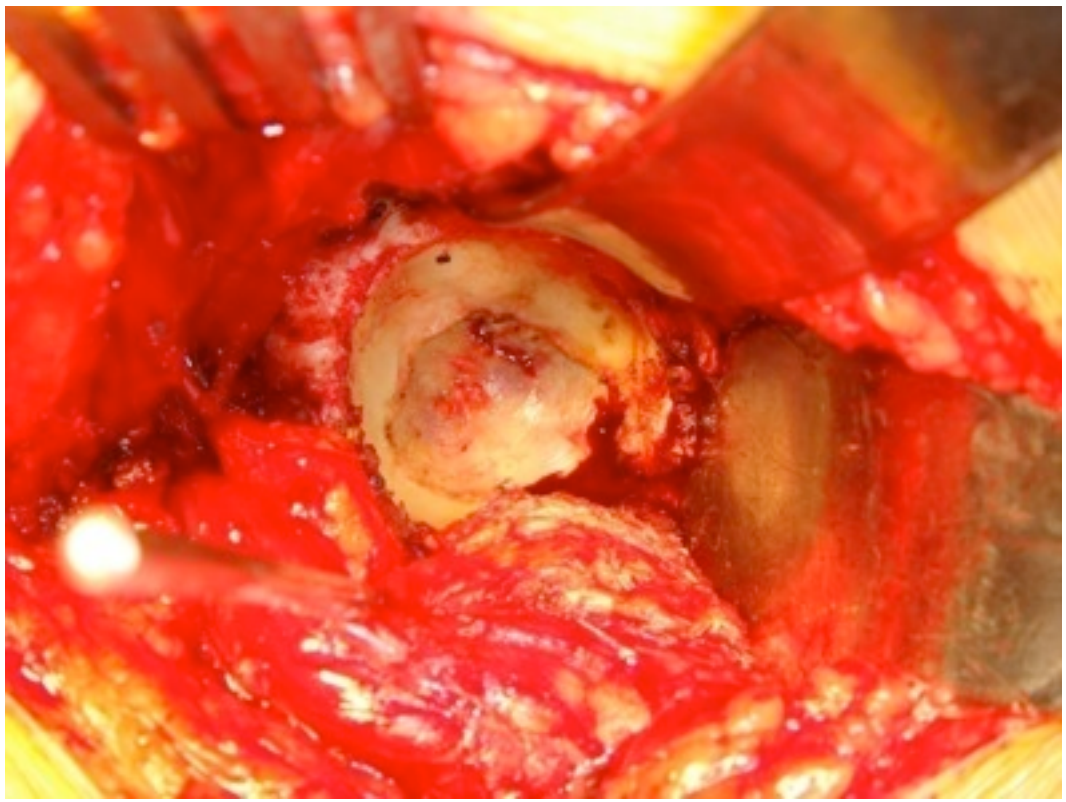
Acetabular preparation

- Ream on the direction of the natural acetabular axis



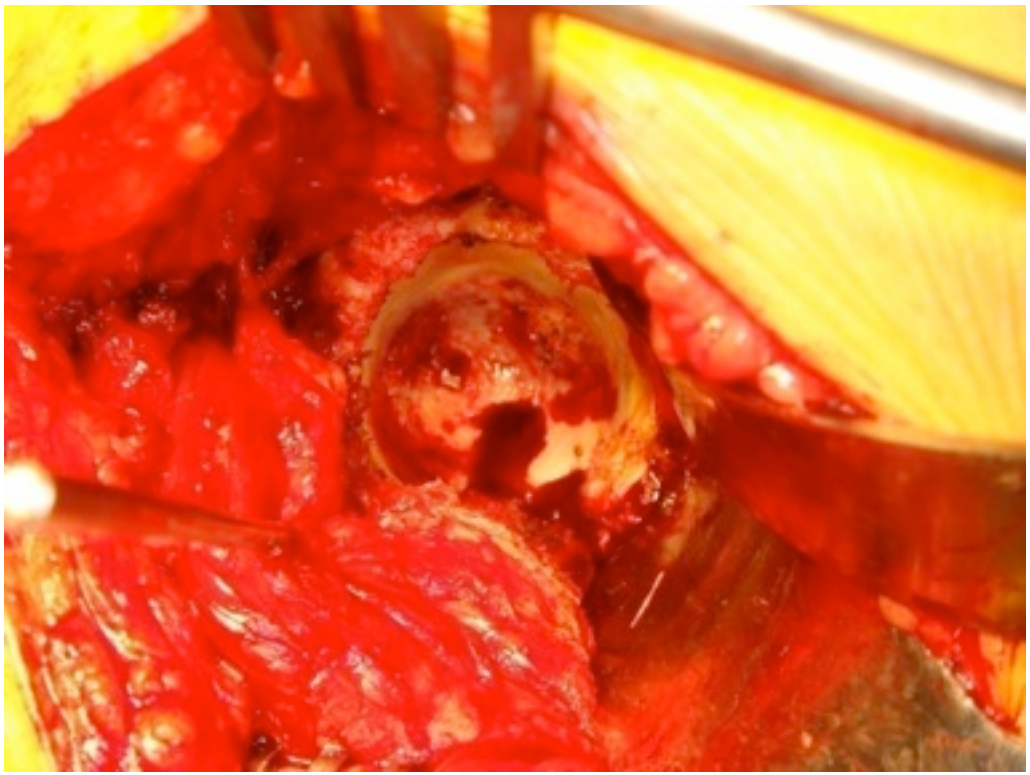
Acetabular preparation

- ***On normal bone***, start reaming medial osteophytes till lateral wall of lamina quadrilatera



Acetabular preparation

- Continue reaming enlarging diameter till observe good cancellous acetabular bone (2mm step)



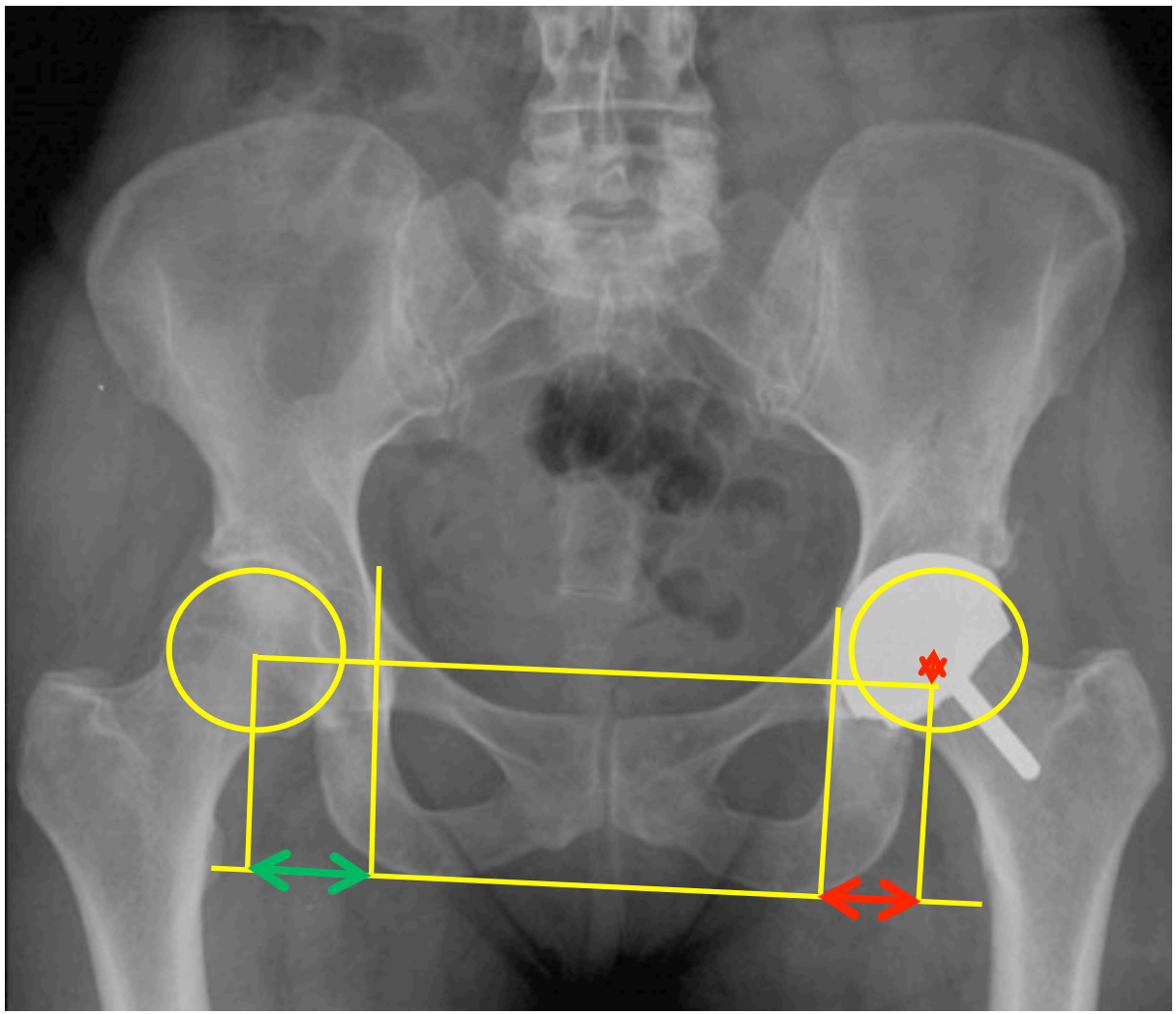
Acetabular preparation

- Look for never over-ream more than planned
- Implant acetabular cup with same ø of the last reamer

Acetabular preparation

Take care…

- If never you need to medialize the cup consider that for prepare the femoral side
  - Medialization = potential instability
- With prosthetic stem you can control offset & leg length better than a resurfacing head



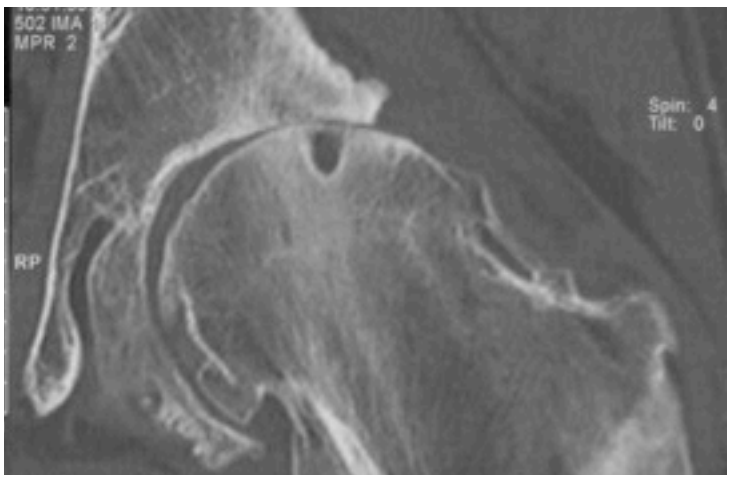
Acetabular preparation

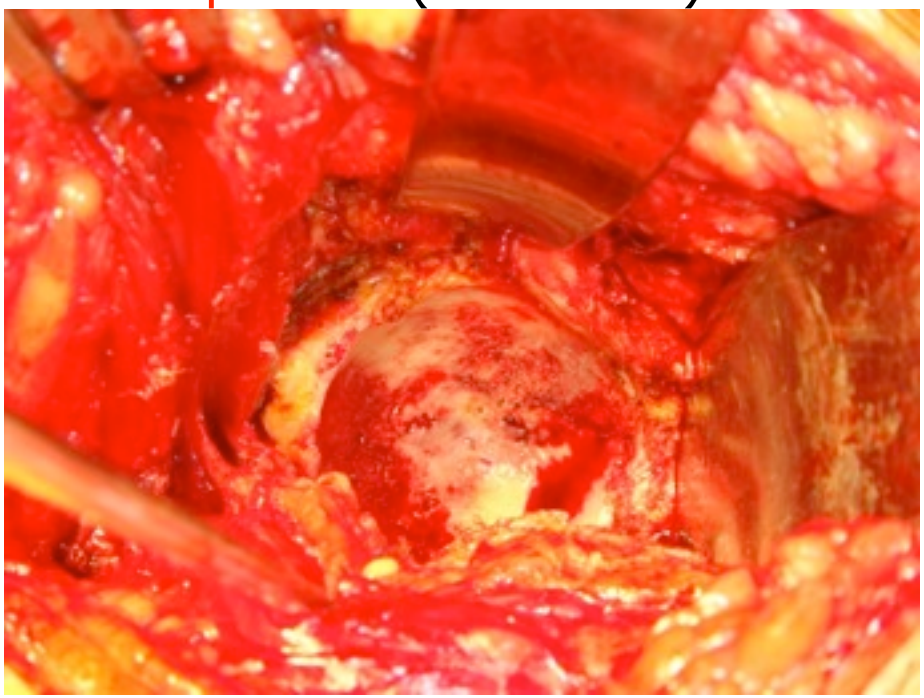
- Reaming… think that…

Named	50	50	50
			
Really	50	50	52

Acetabular preparation

- ***On sclerotic bone***, Continue reaming enlarging diameter +1mm than the final diameter for implant acetabular cup:
  - Classical reamer 2mm steps
    - till final dimension for cup (ex.: 50mm)
  - Additional +1mm reamer (entry) (ex.: 51mm)
  - Implant cup for original dimension planned (ex.: 50mm)



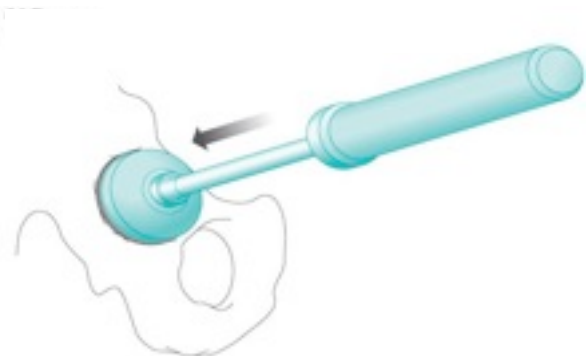


Acetabular preparation

- ***Implanting cup***

- Use cup positioner
  - Straight
  - Angulated (for MIS)

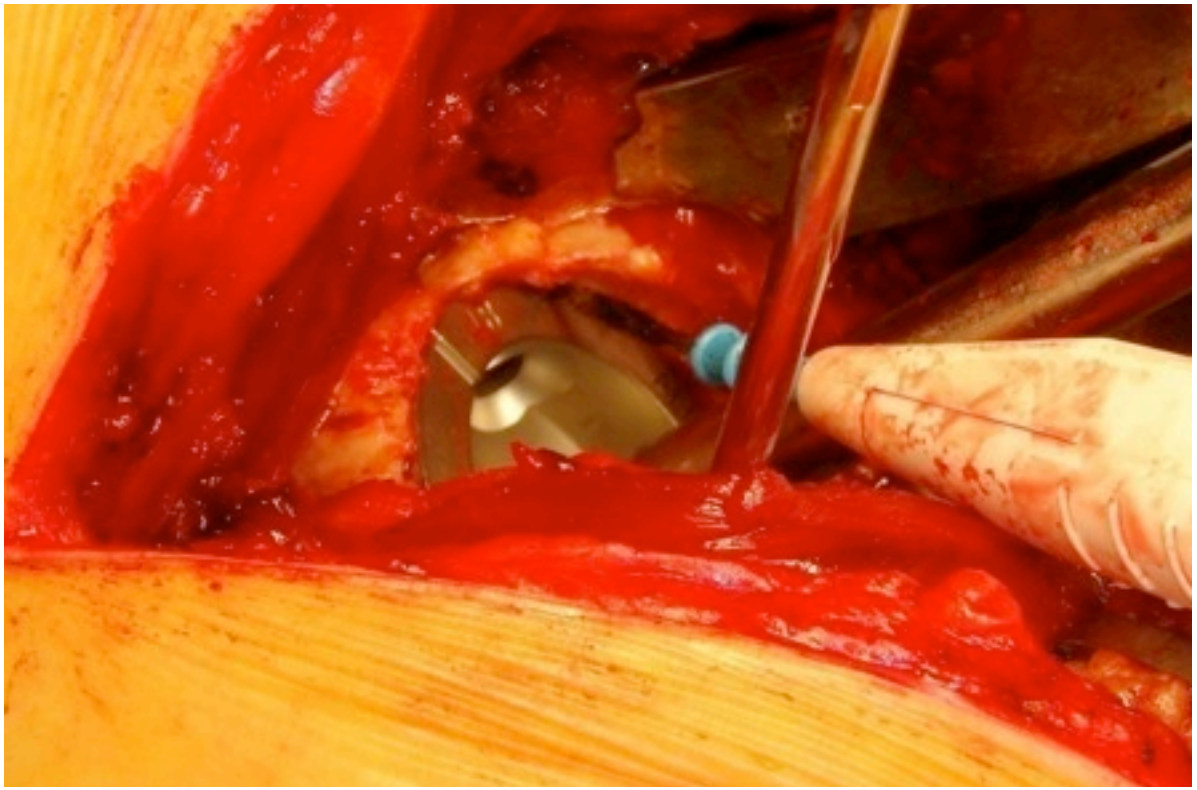
- Achieve final cup impaction



Acetabular preparation

- ***Implanting cup***

- Difficult to have a visual control of end penetration of acetabular cup
  - "Draw" with acetabular trial

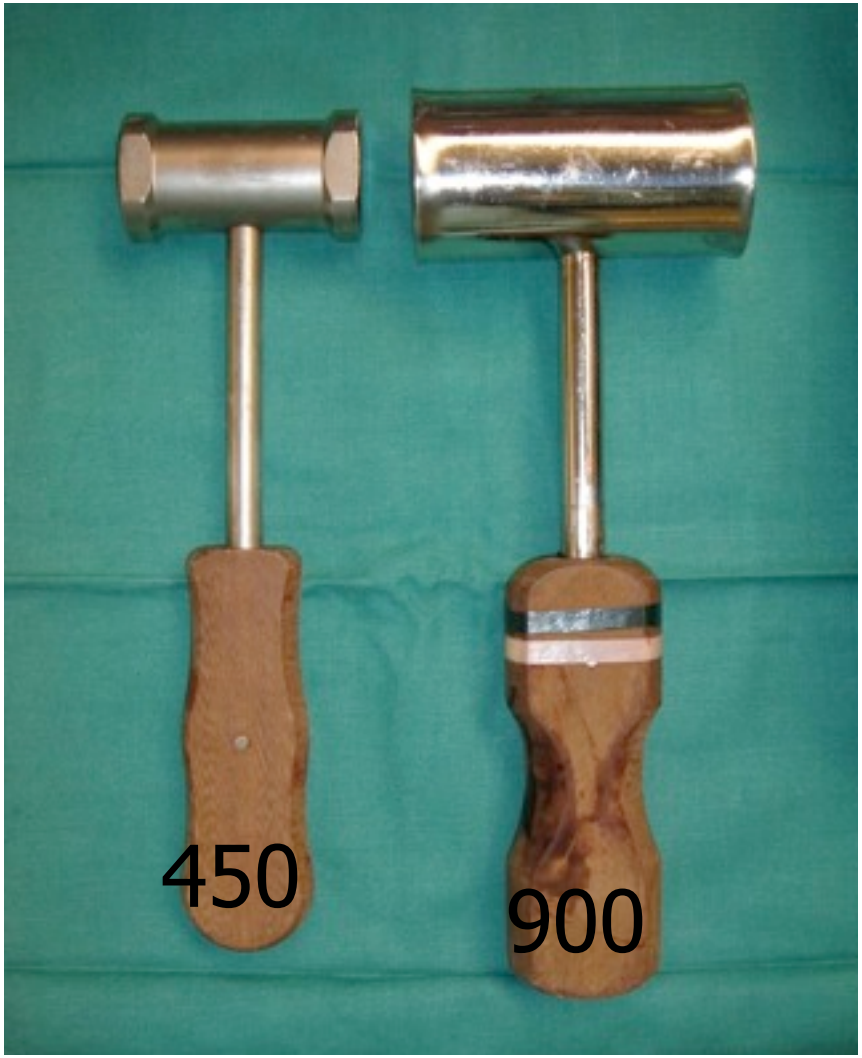


Acetabular preparation

- ***Implanting cup***

- Use 900 gr hammer
  - Handle with care
    - Risk of fracture

- Difficult to modify cup position after implantation



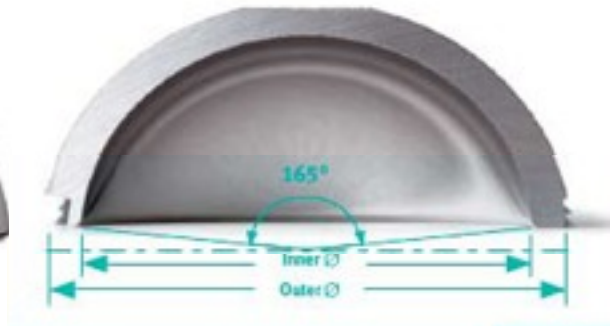
Acetabular preparation

- ***Implanting cup***
- Well cover the cup on the original acetabulum
  - Avoid excessive anteversion
    - ➢ posterior femoral neck impingement in external rotation
  - Avoid excessive verticalization
    - ➢ inferior femoral neck impingement in adduction
  - Avoid excessive medialization
    - ➢ Coxa protrusa effect: less ROM + pain
    - ➢ Leg length shortening & instability + clunk syndrome

Impingement
- Risk of dislocation
- Loosening & wear
- Pain

Thath's normal ?

… after implantation my cup seems to be deeper than the trial…



Thath's normal ?

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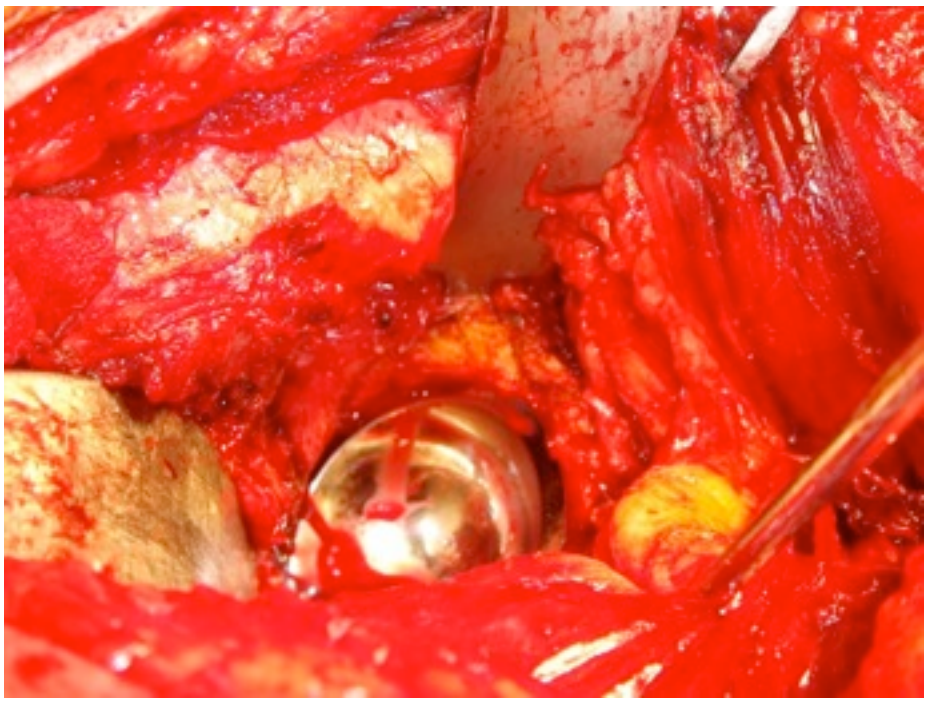
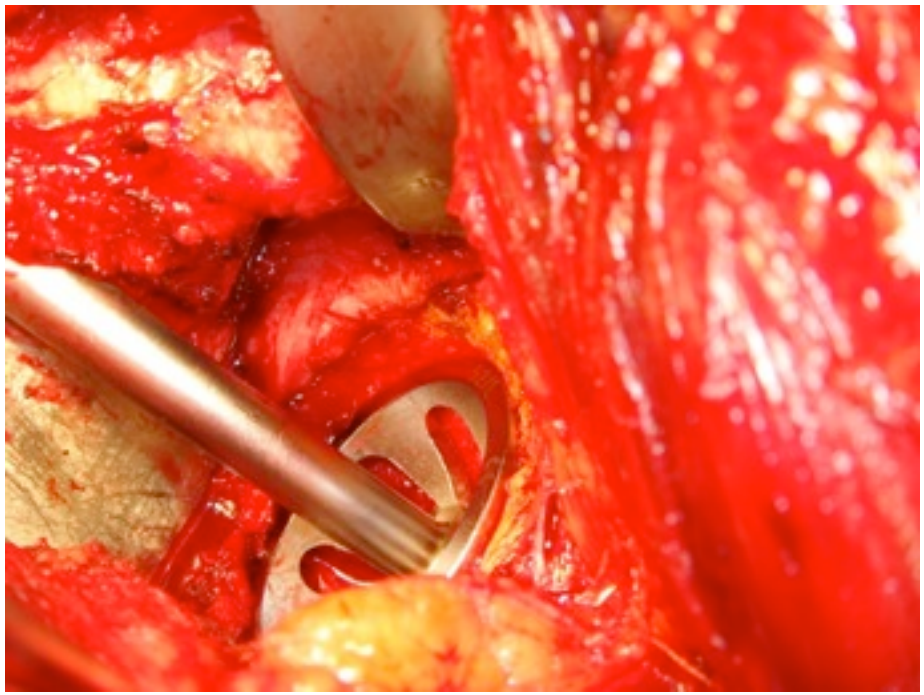


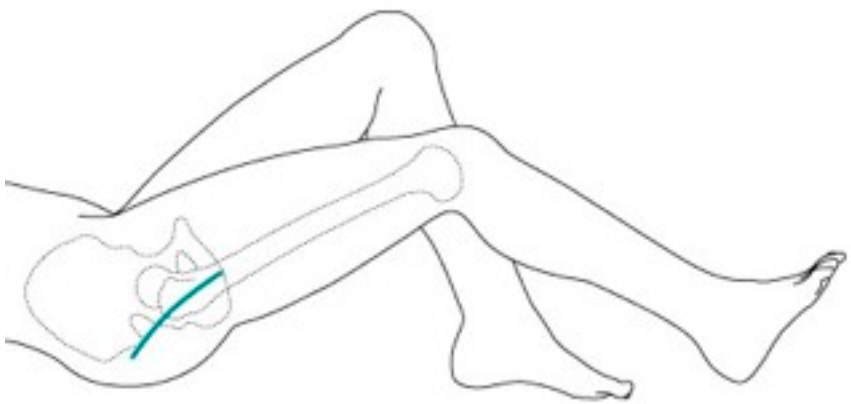


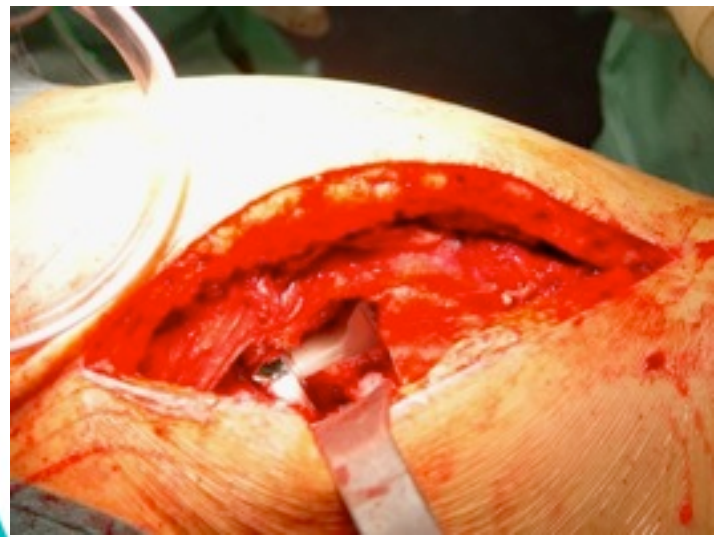
Series

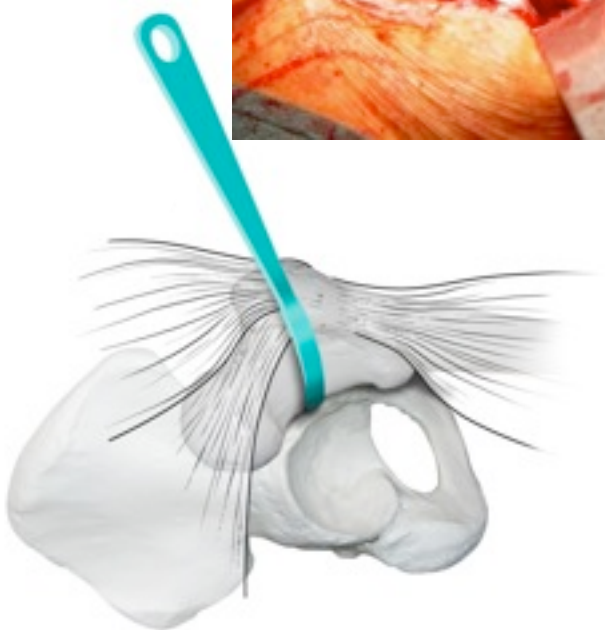
- 300 patients
  - 200 DUROM resurfacing THR's
  - 100 Metasul LDH / Metabloc THR's
- 1 senior surgeon
- 2001-2006

Surgical technique

- Posterior approach (25 – 30 cm)
- Well exposure of acetabulum, femoral head and neck
- Possibility of reconstruction







Results

	DUROM 0-100	DUROM 101-200	LDH/Metabloc 0-100
Incision	45 cm	30 cm	10 cm
Time of surgery	180 min	110 min	50 min
Blood loss	650 ml	262 ml	127 ml
Extension of incision	31	2	0
Intraoperative fractures	0	0	0
Vascular complications	0	0	0

Results

	DUROM 0-100	DUROM 101-200	LDH/Metabloc 0-100
Neurological complications	0	0	0
Pulmonar embolism	1	0	0
Infections	0	0	0
Vertical cup	1	0	1
Extruded cup	3	0	0
Horizontal cup	0	0	0

Results

	DUROM 0-100	DUROM 101-200	LDH/Metabloc 0-100
Varus head	3	0	-
Neutral head	74	30	-
Valgus head	20	61	-
Postoperative fractures	1	0	0
Conversion with stem	3	9	-

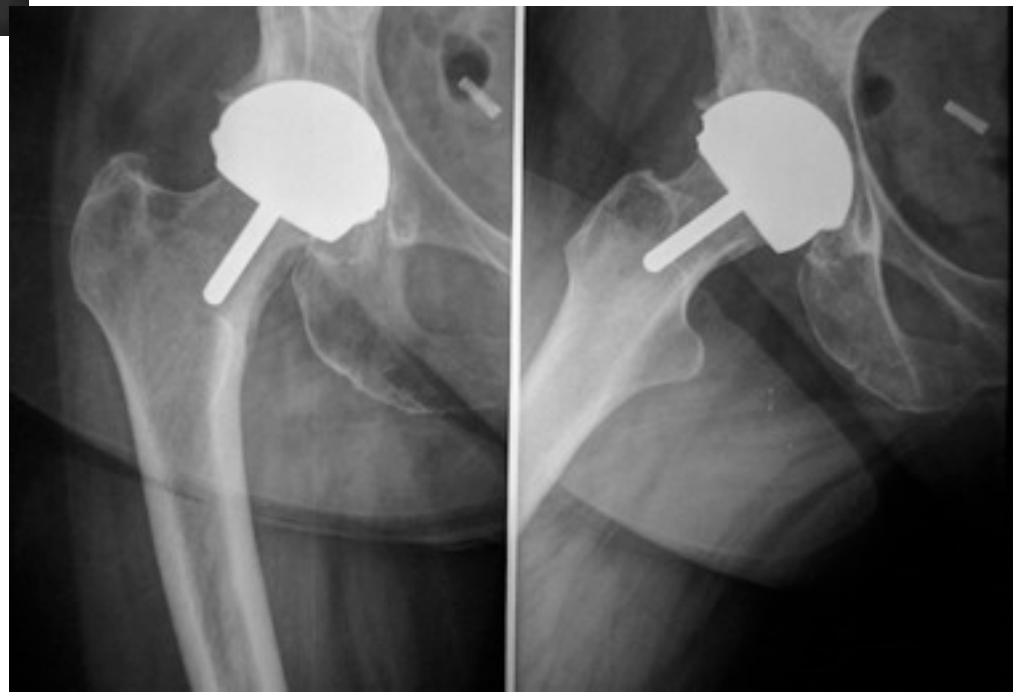
Results

	DUROM 0-100	DUROM 101-200	LDH/Metabloc 0-100
Reoperations	1	0	0
Walking	4 days	2 days	2 days
Stairs	6 days	3 days	3 days
Monopodal bearing	6 days	3 days	3 days
Mean hospital stay	8,4 days	4,3 days	3,9 days
Residual pain	1	0	0

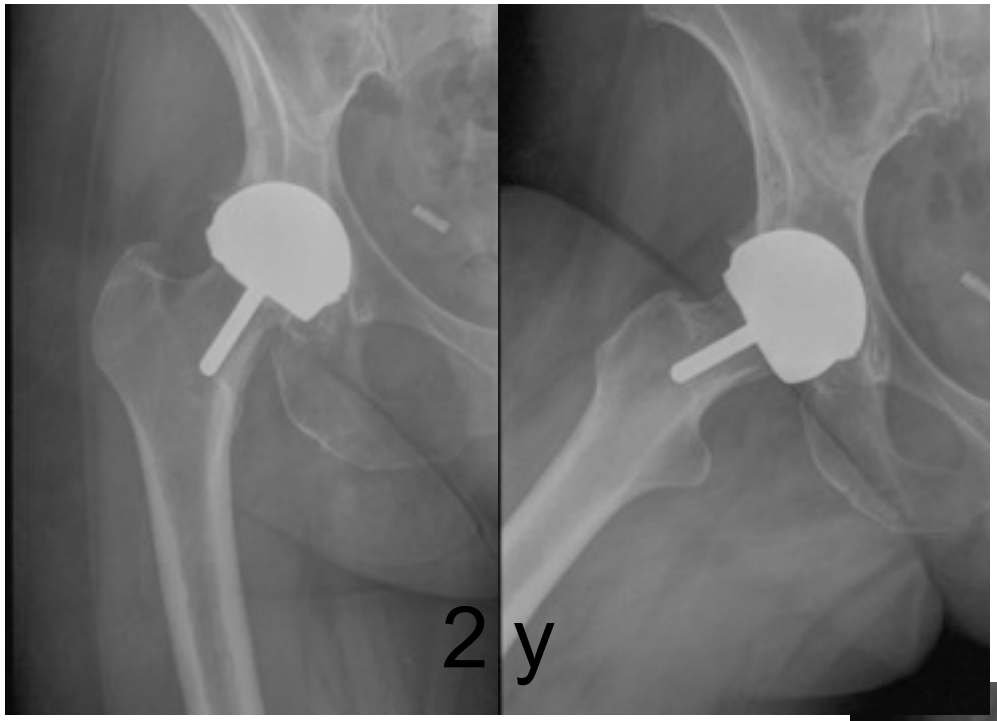
410202 0CC 63Y

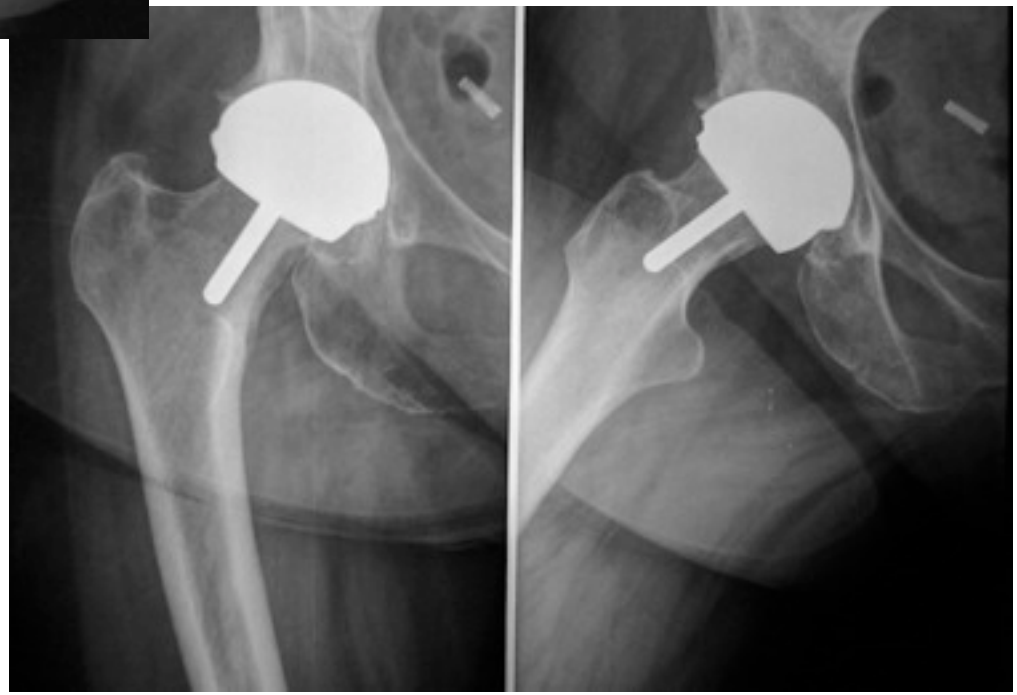
410202 0CC 63Y

410202 0CC 63Y



410202 0CC 63Y

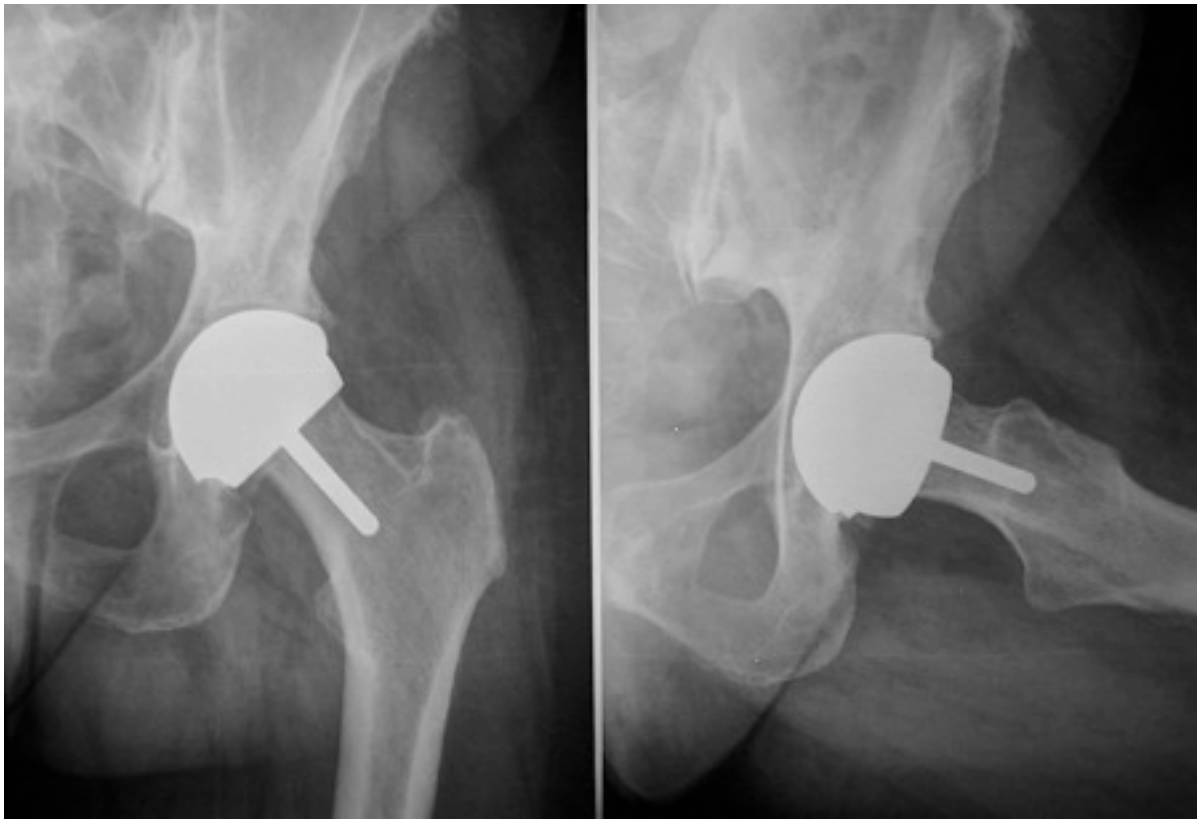




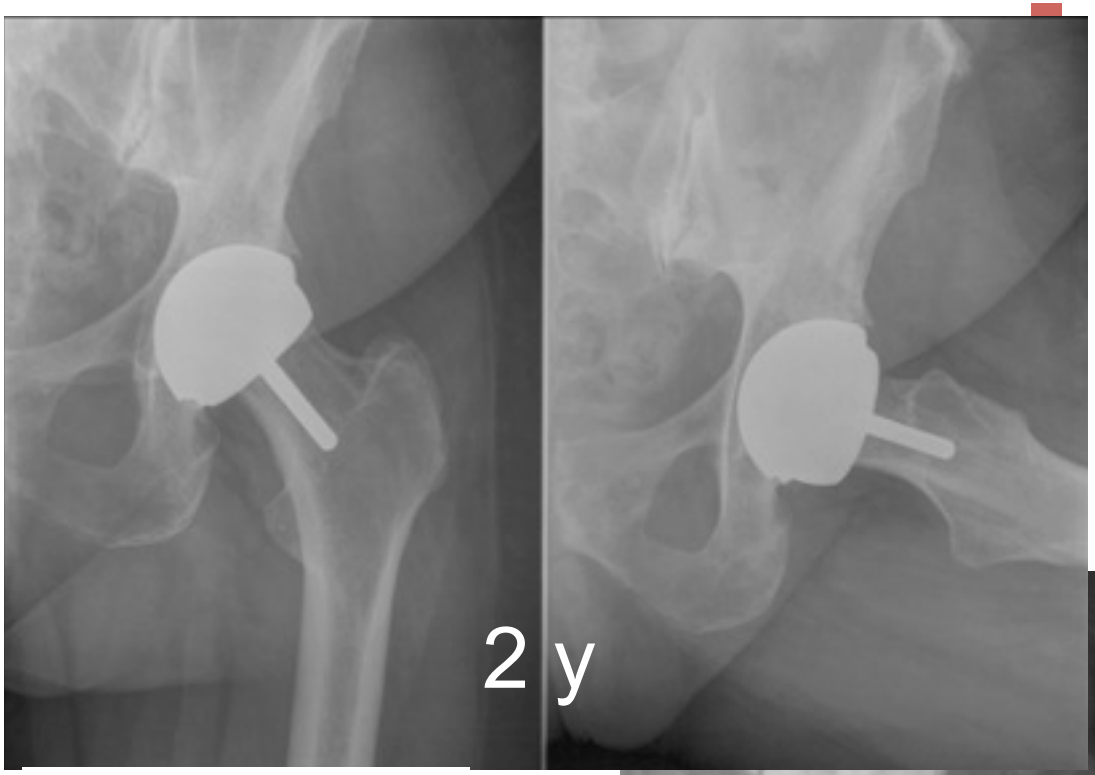
430706 0FG 61Y

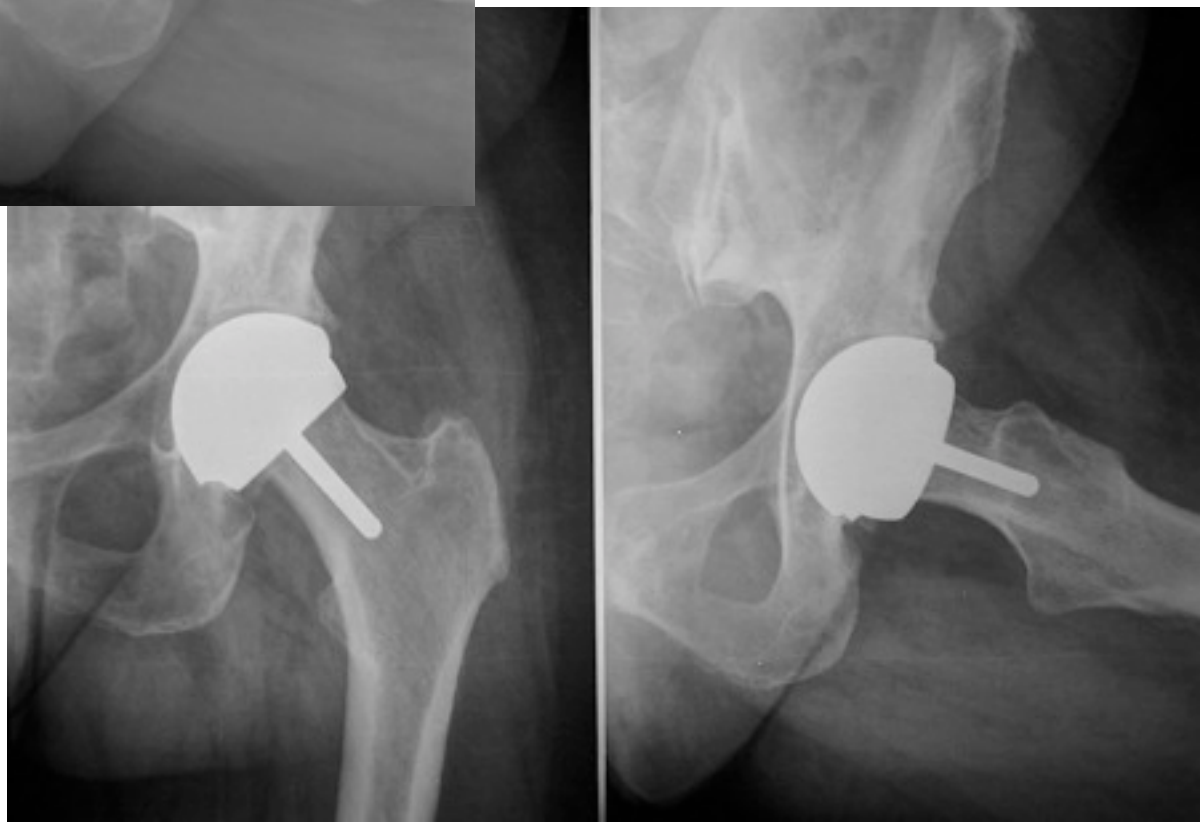
430706 0FG 61Y

430706 0FG 61Y



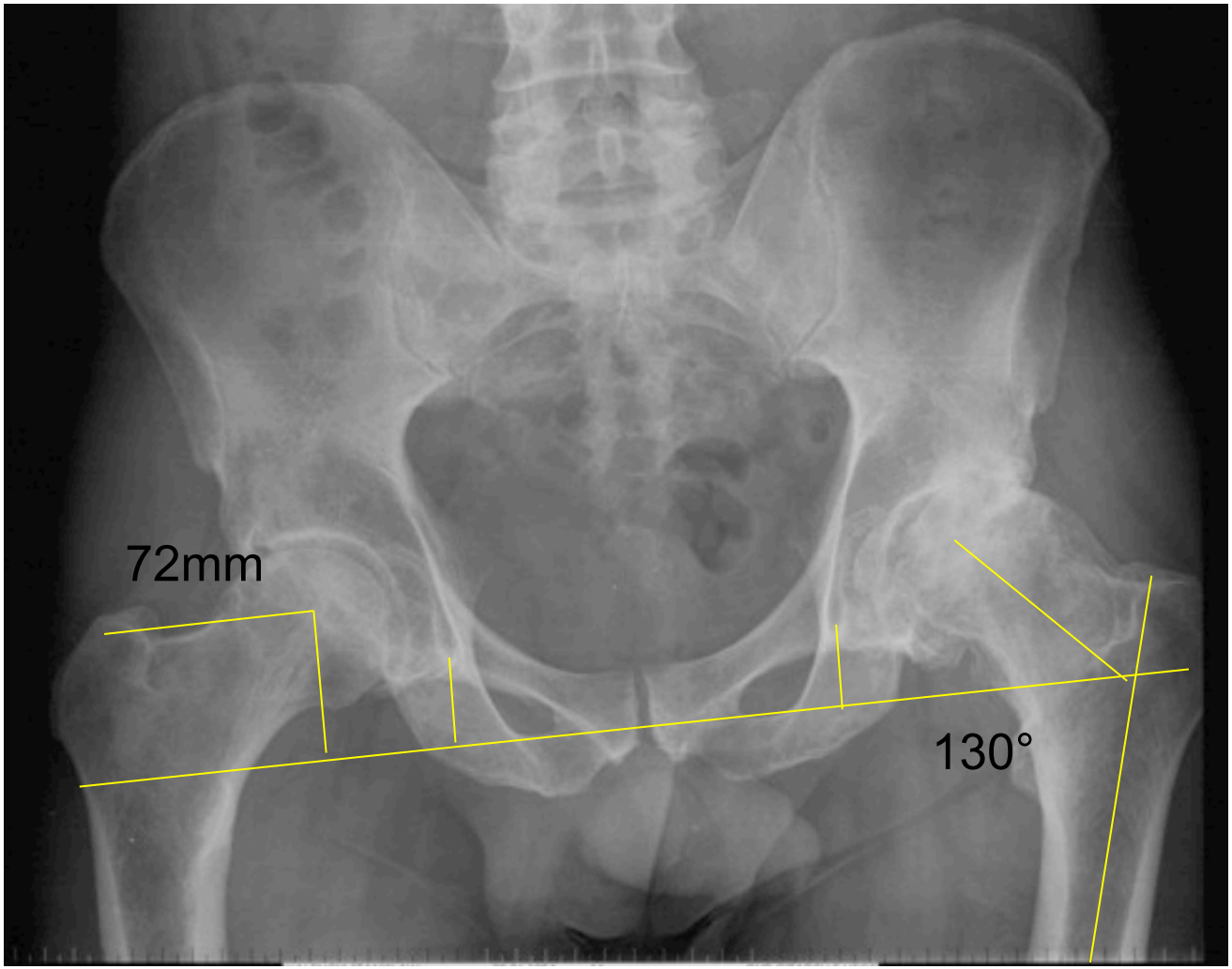
430706 0FG 61Y





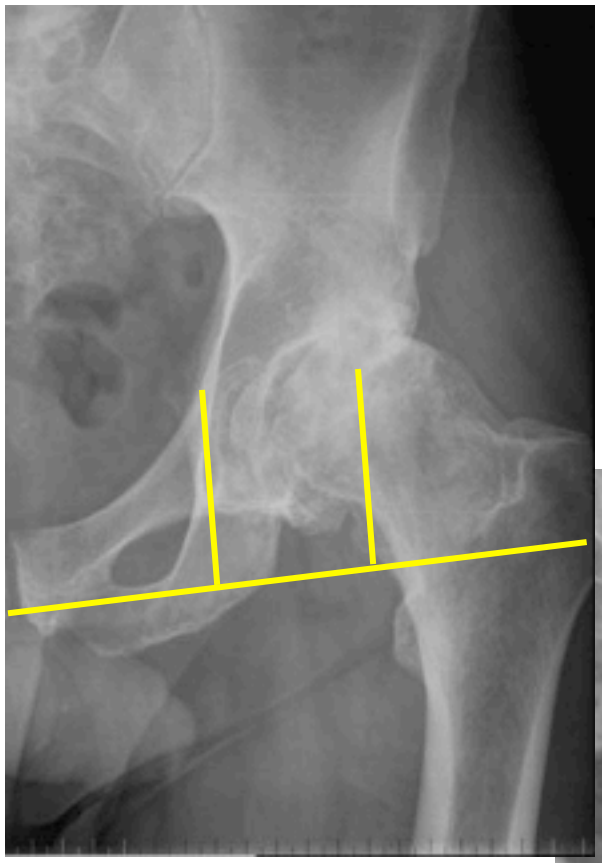
440420 ORE 60Y

540622 1WS 50Y

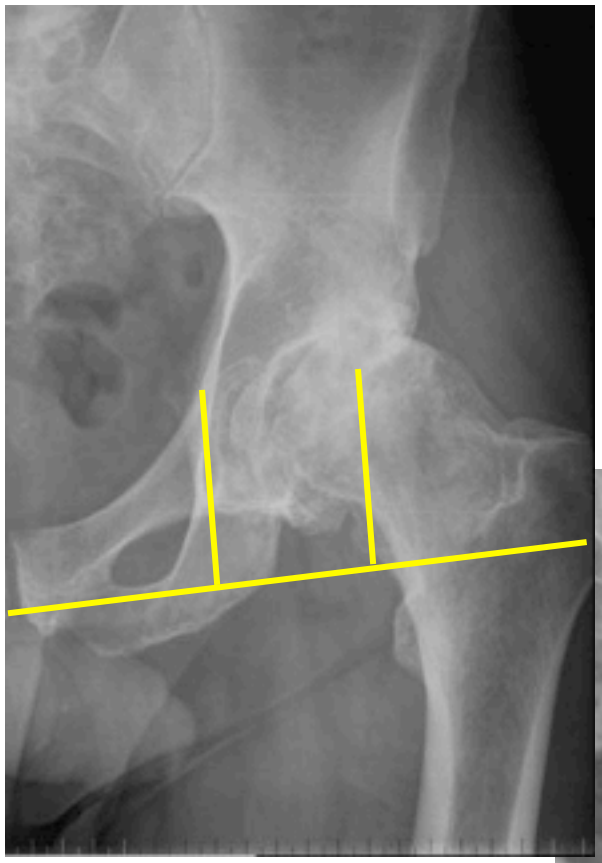


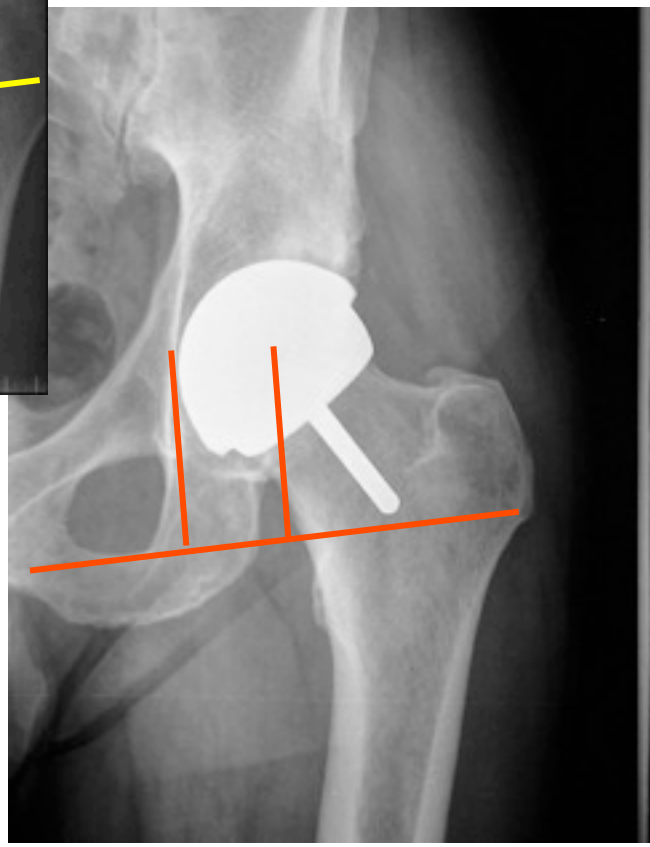
540622 1WS 50Y

540622 1WS 50Y



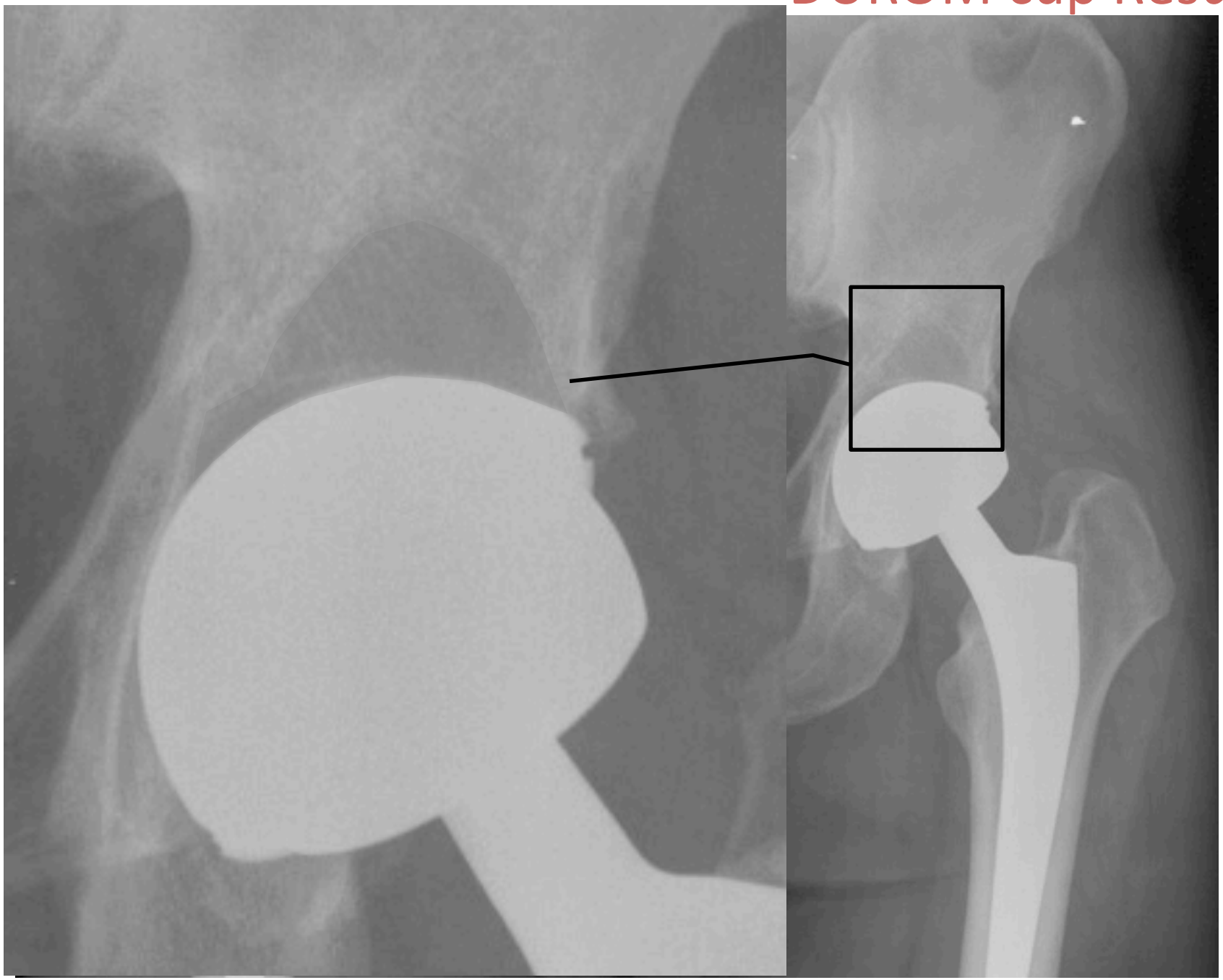
540622 1WS 50Y



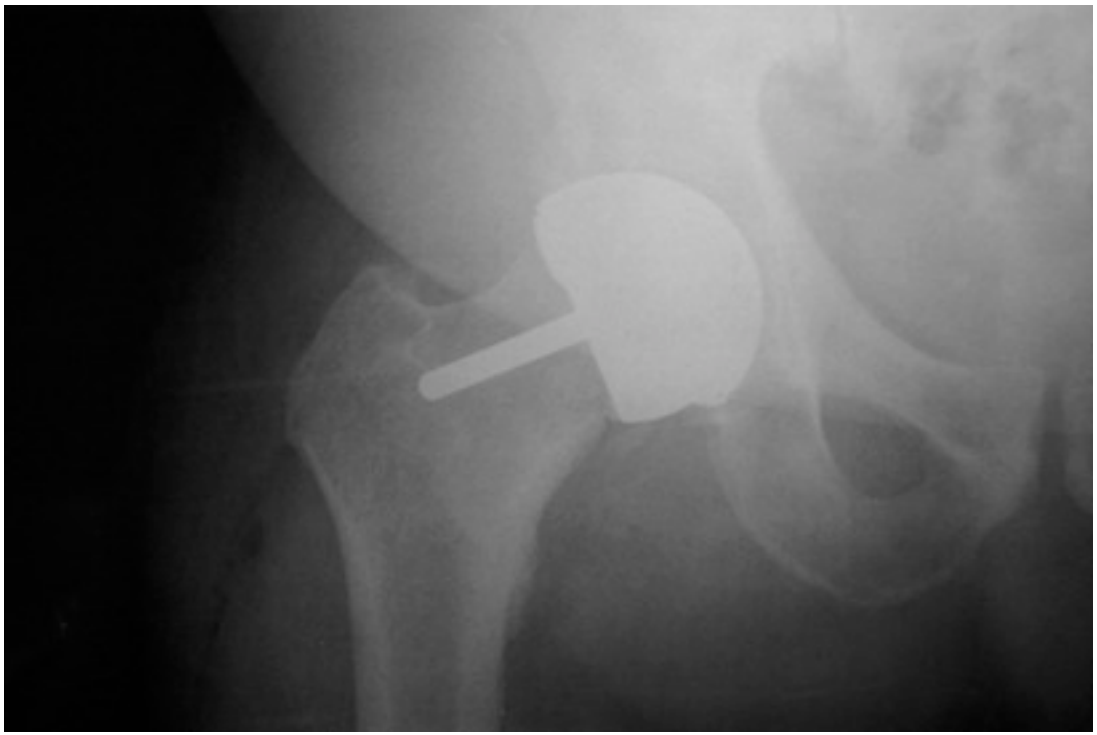


DUROM cup Results

DUROM cup Results



310324 1DJ 73Y



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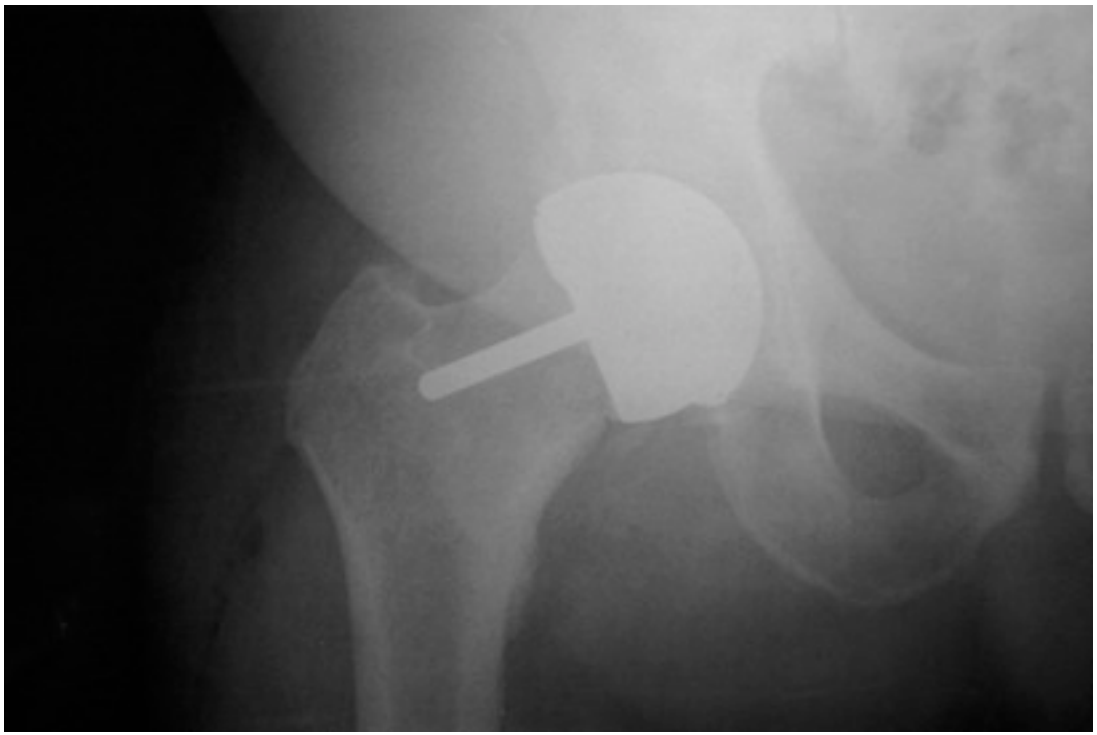
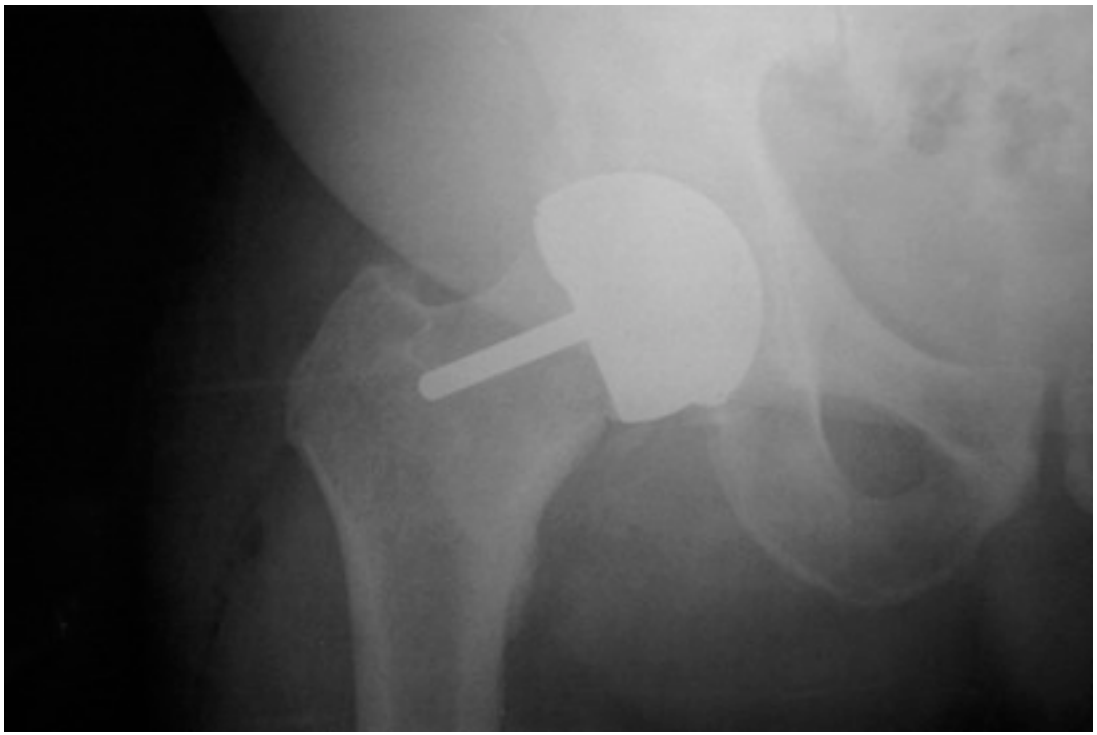
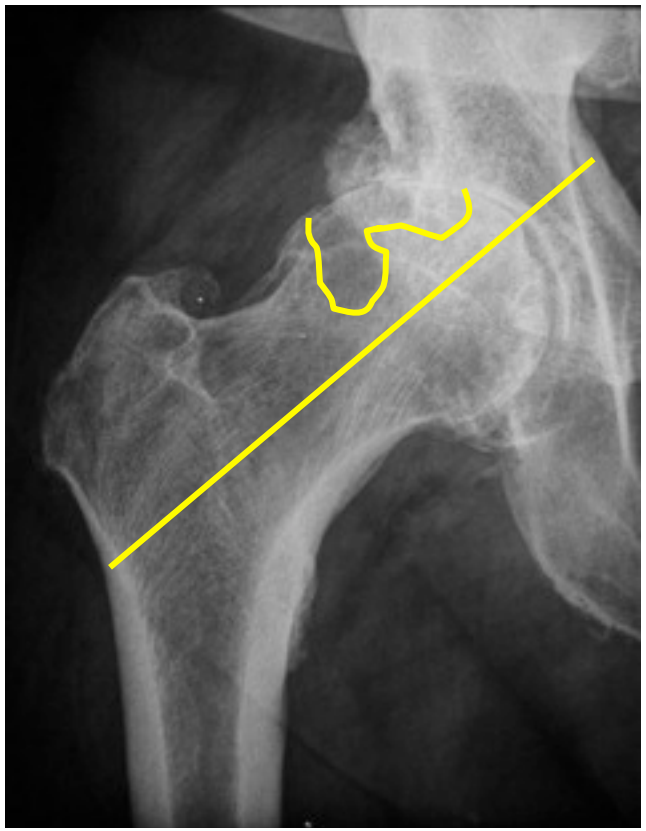
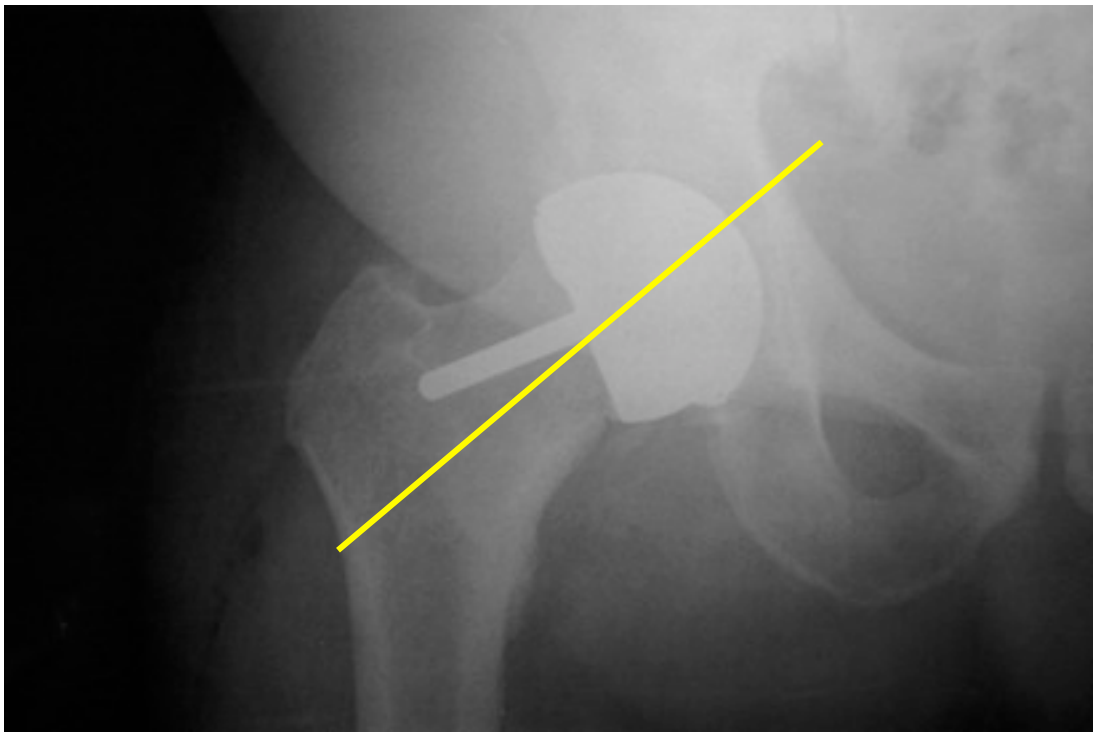




310324 1DJ 73Y





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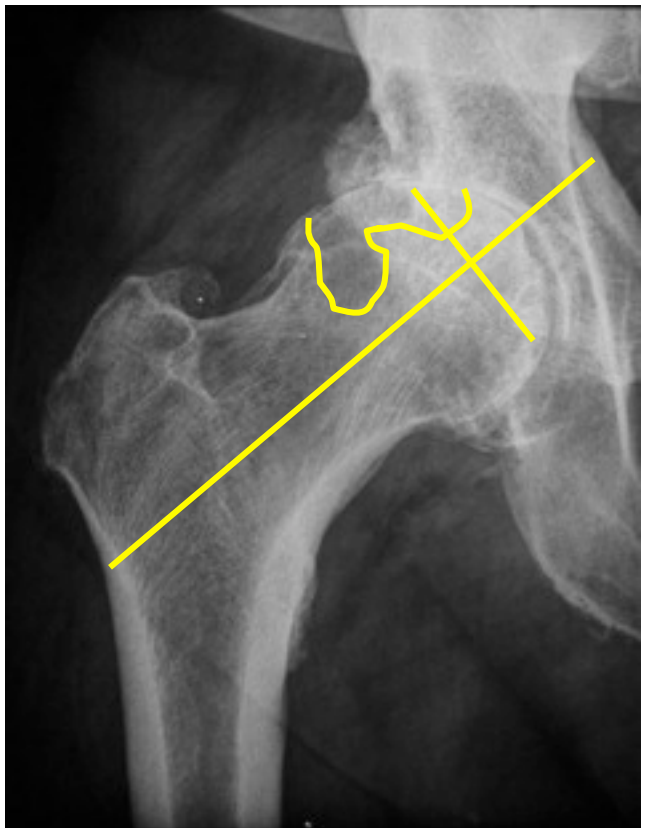

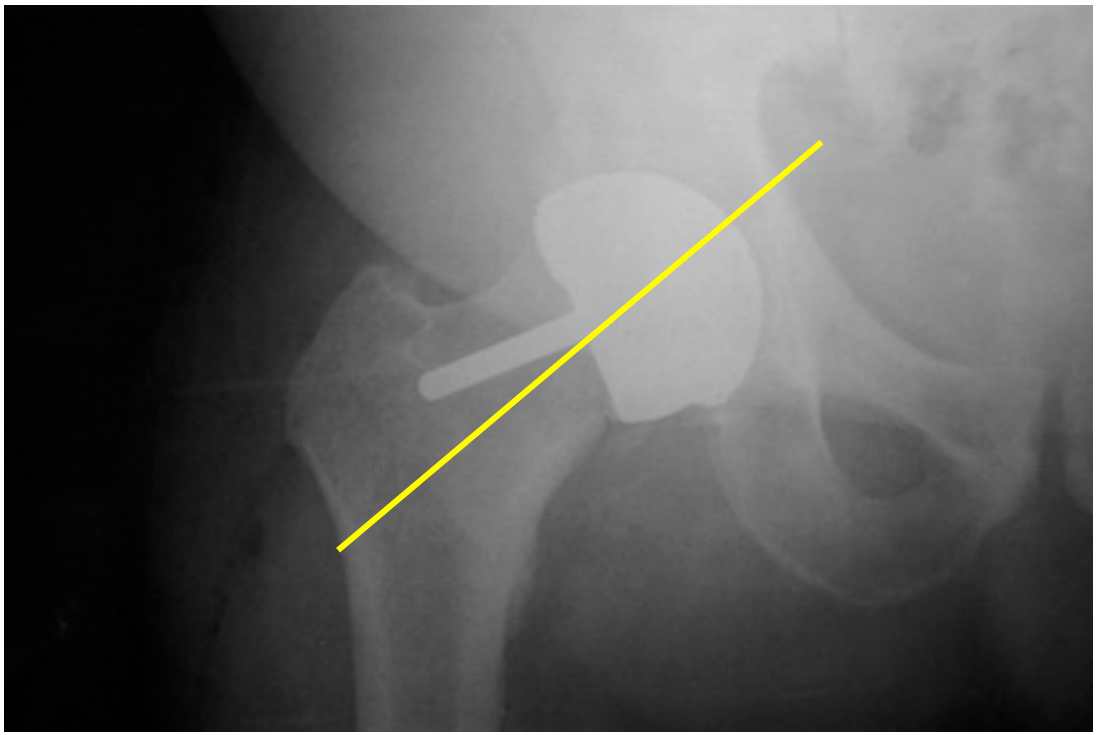

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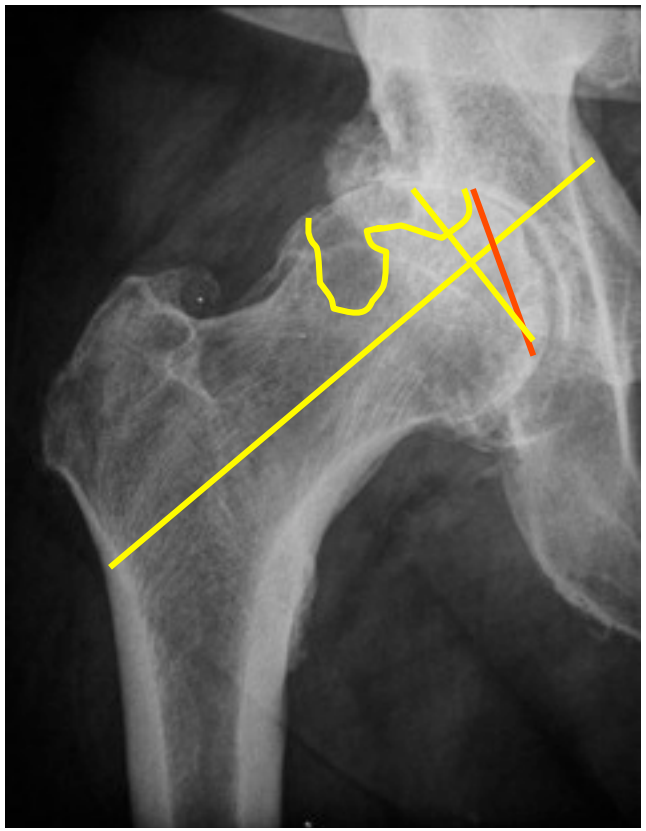

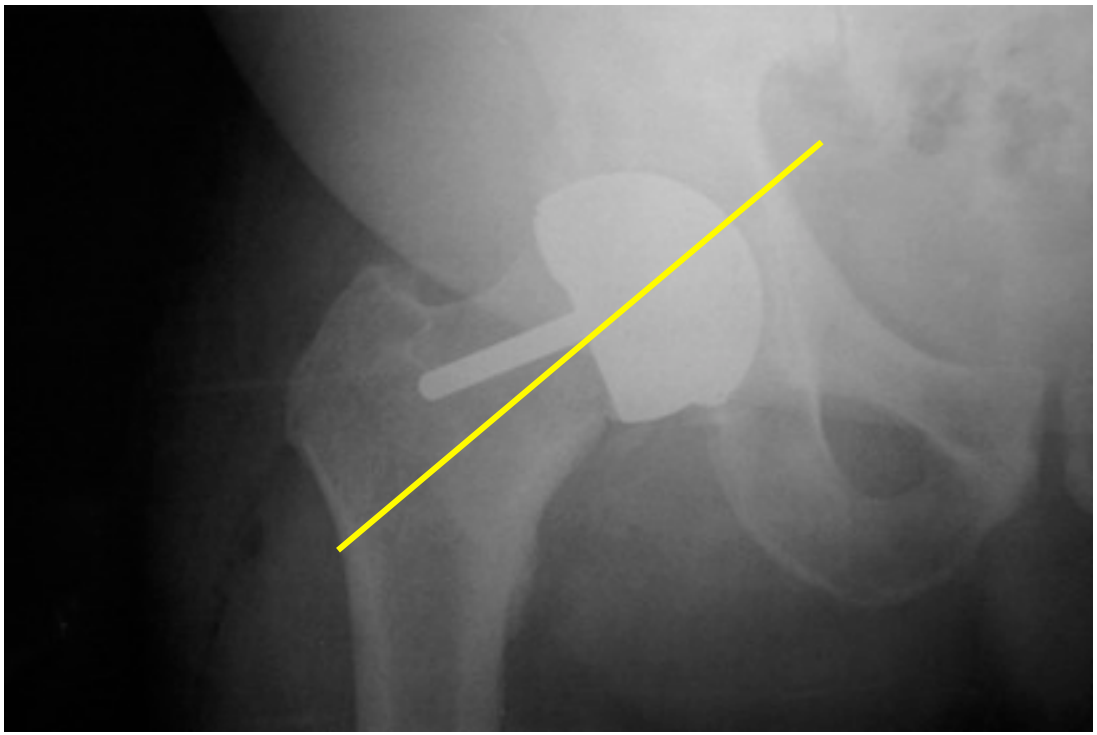

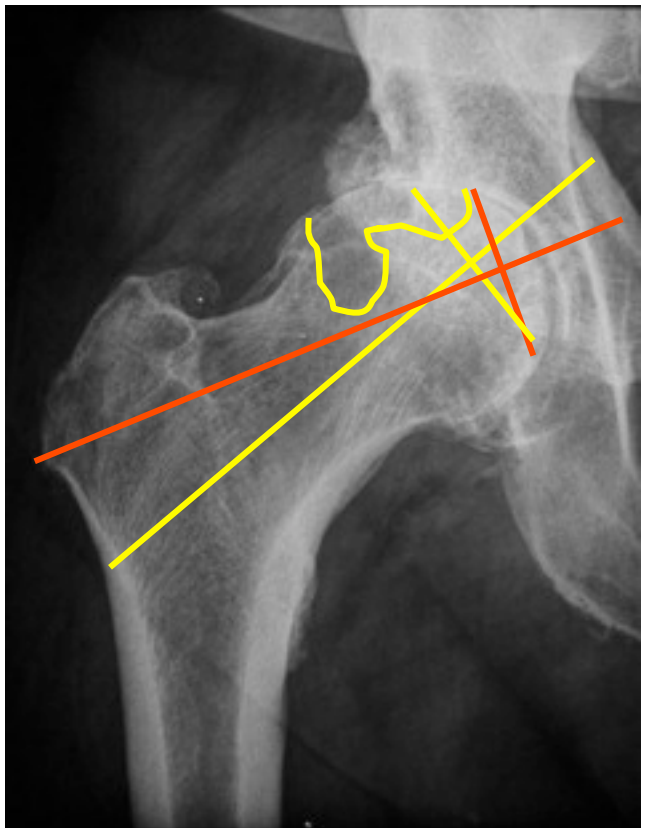

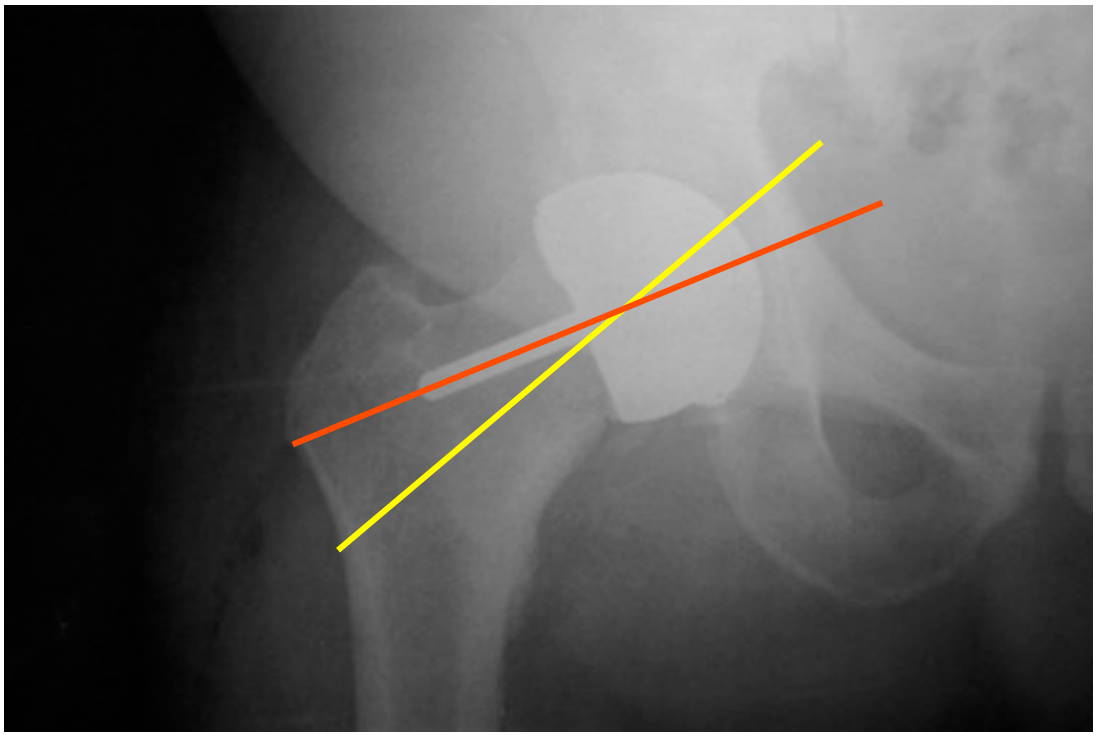

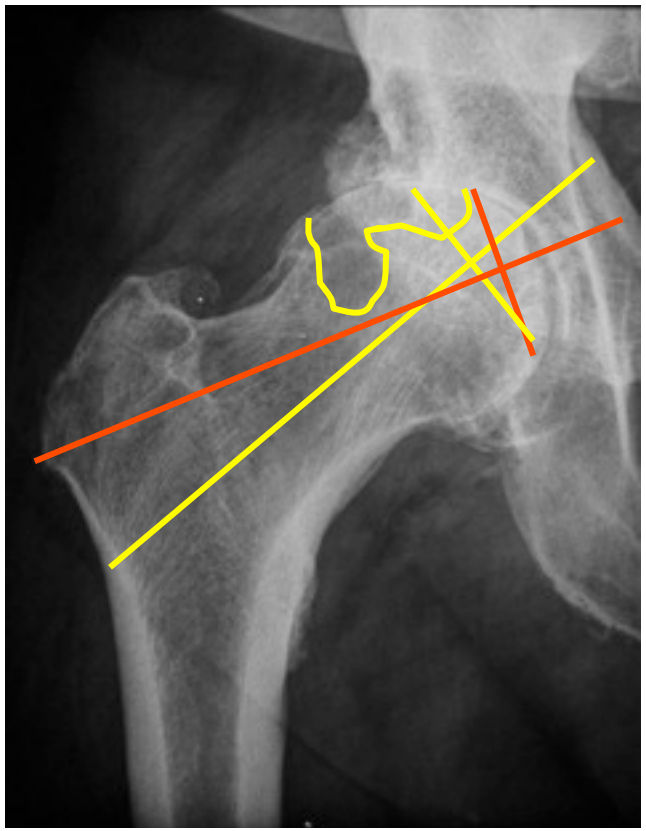

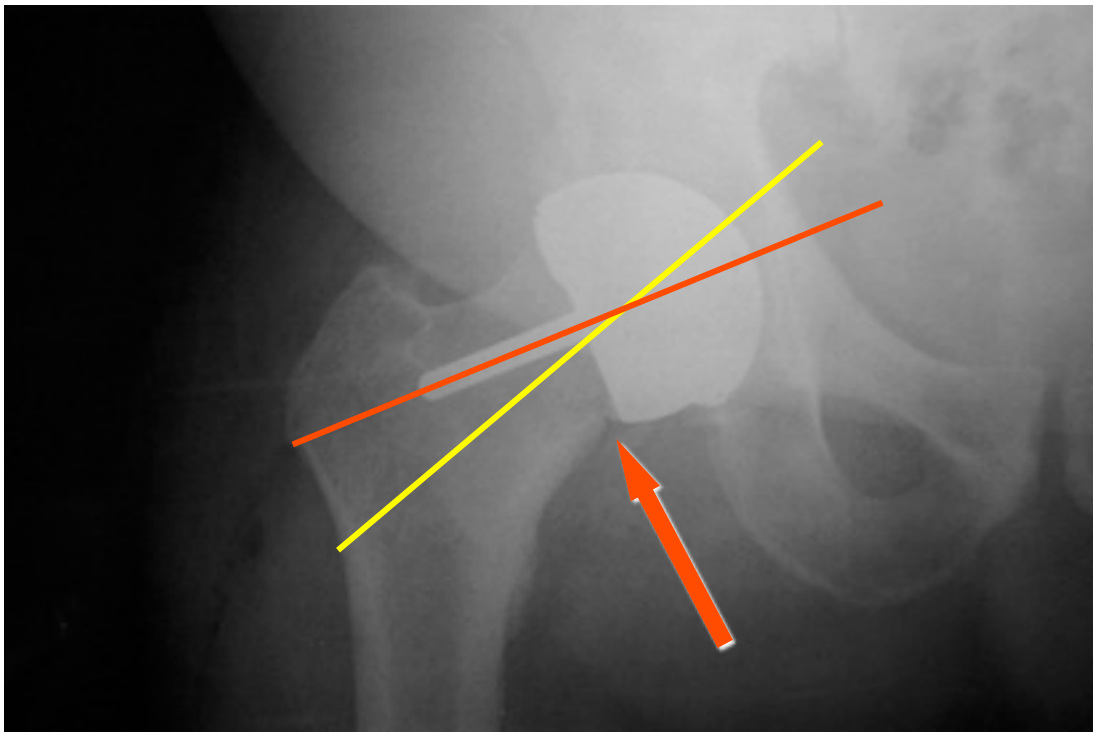

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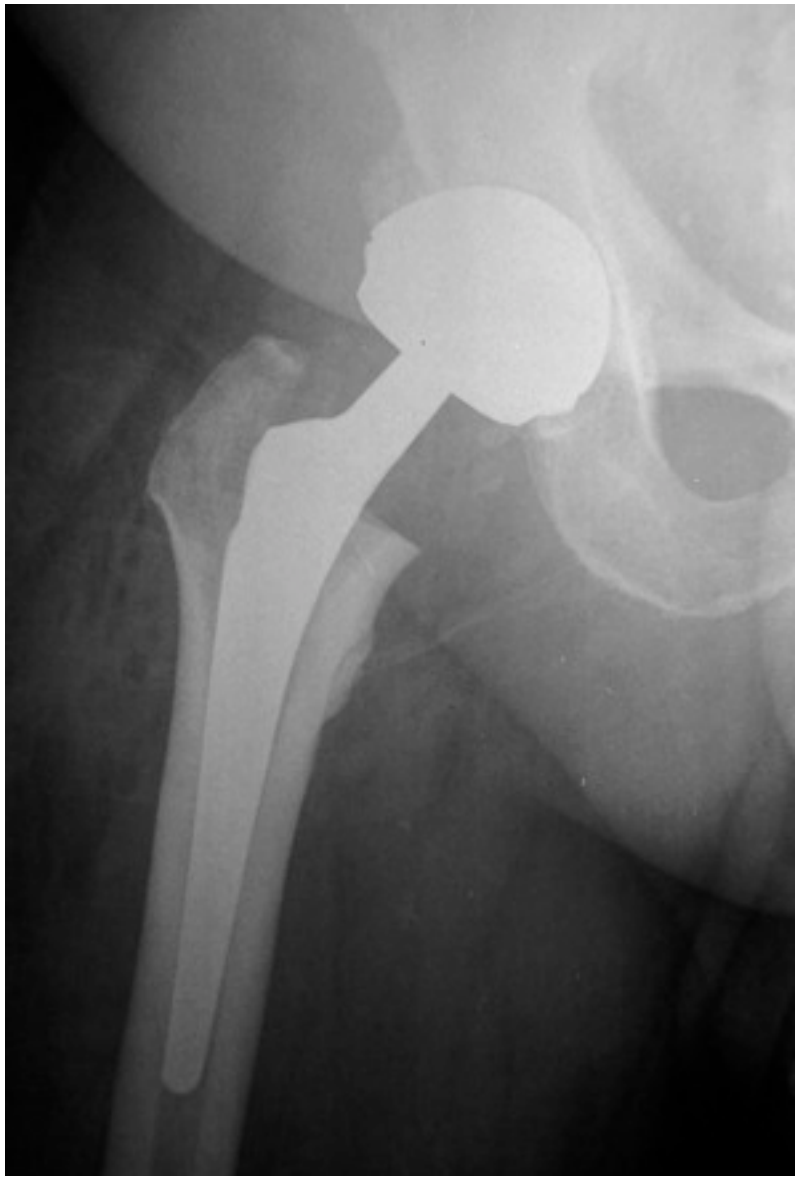


Conclusions

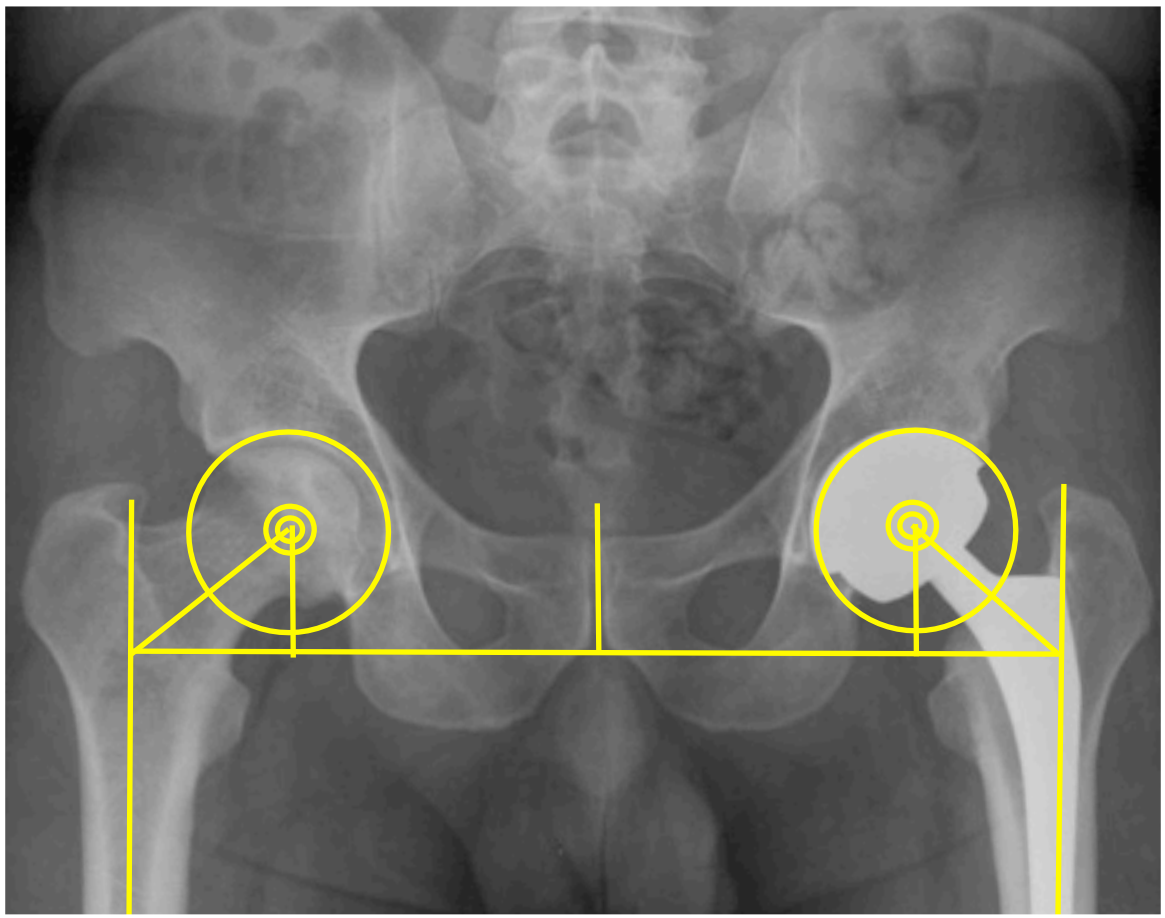
- Be careful concerning indications
- Take your time for prepare cases
- Preoperative planning is very HELPFUL
- Choose posterior approach as the more sure & simple
- Obtain cup primary press-fit is mandatory
- Consider the use of DUROM cup with resurfacing head or femoral stem depending of hip morphology & pathology

Conclusions

- Bone preservation in young patients
  - Selected cases
  - “respected” anatomy
  - Bone quality
- Technically demanding procedure
- Complex control of positioning neck axis
- Learning curve… some errors may be accepted !?
- Short term good clinical results

- Be careful with indications on Resurfacing
- Consider LDH/stem as a valid alternative…

… better than Resurfacing?

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