Pre Operative Planning in Total Hip Arthroplasty

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CDDFT

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“Prior preparation and planning prevents poor performance”

“Failing to Plan is planning to Fail”

Pre operative planning

- Introduction – why
- History
- Examination
- Templating
  - X – Ray assessment
    - » Bone defeciency or excess
    - » LLD
    - » Centre of rotation of acetabulam / femoral head
    - » Offset
    - » Neck resection level
  - Digital Templating 2D
  - Future - 3D templating

Aim

- **For the Patient**
  - **Improved result**
  - **Helps to restore - Anatomic centre of rotation**
  - **Offset and leg length**
- **For the Surgeon**
  - **Shorter Learning curve**
  - **Reduced Operating time**
  - **Fewer complications**

J Am Acad Orthop Surg. 2005 Nov;13(7):455-62.

Preoperative planning for primary total hip arthroplasty.

Hospital for Special Surgery, New York

"Meticulous preoperative planning allows the surgeon to perform the procedure expediently and precisely, anticipate potential intraoperative complications, and achieve reproducible results"

History

- Pathology – Previous RT / Surgery /AVN
  - Determines surgical approach and choice of implants
- Previous Surgery
  - Rule out infection
  - Read the surgical operation notes

Examination

- Signs of Infection
    - Healing by secondary intention
    - Sinus scars
- Pelvic obliquity secondary to spinal deformity
- Leg length Discrepancy-
    - ? apparent / true
- Fixed flexed or a Rotation deformity
- Previous Surgical Scars
    - Site / number
    - Integrity of Abductors

Exclude infection

Templating

1. Acetate Templates
2. Digital 2D
3. Digital 3D

X-Rays

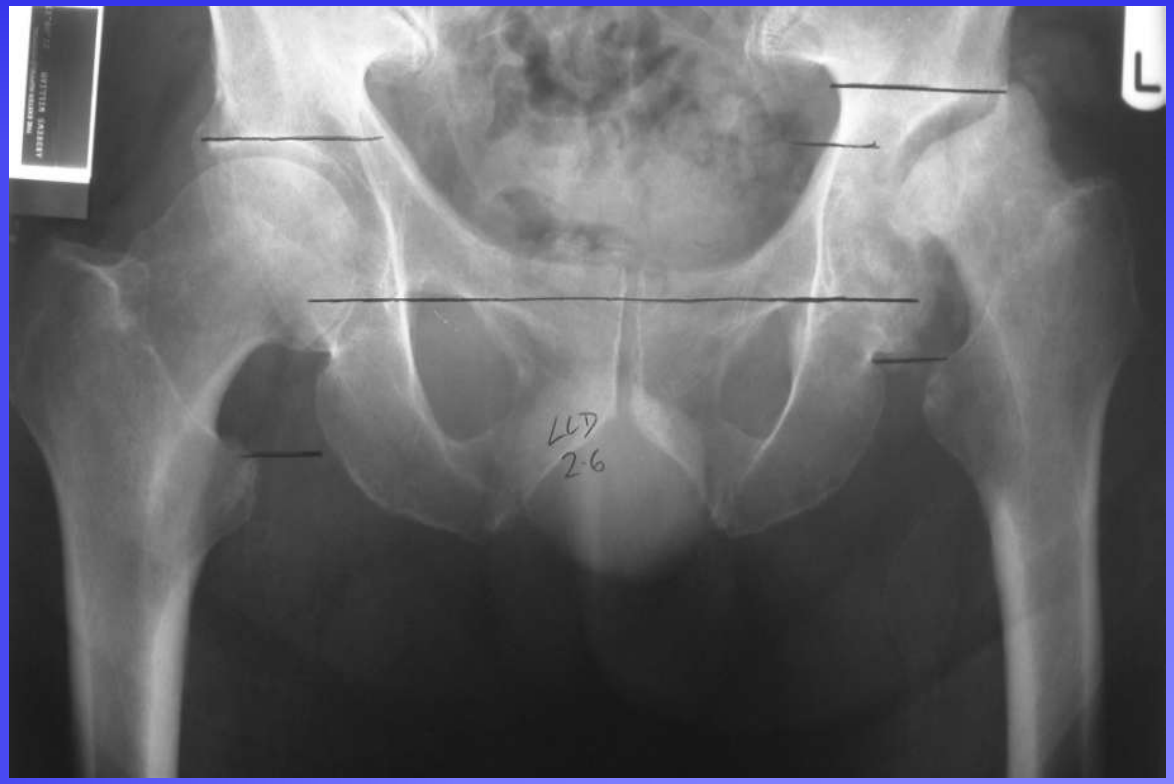
- Recent
- AP pelvis - 15º IR
  - What if you don't
  - How do you know it is the correct projection
- AP & Lat to below tip of prosthesis
- ? Further imaging
- Assume 120% magnification unless you have a measured marker / THR on the x rays

X-rays

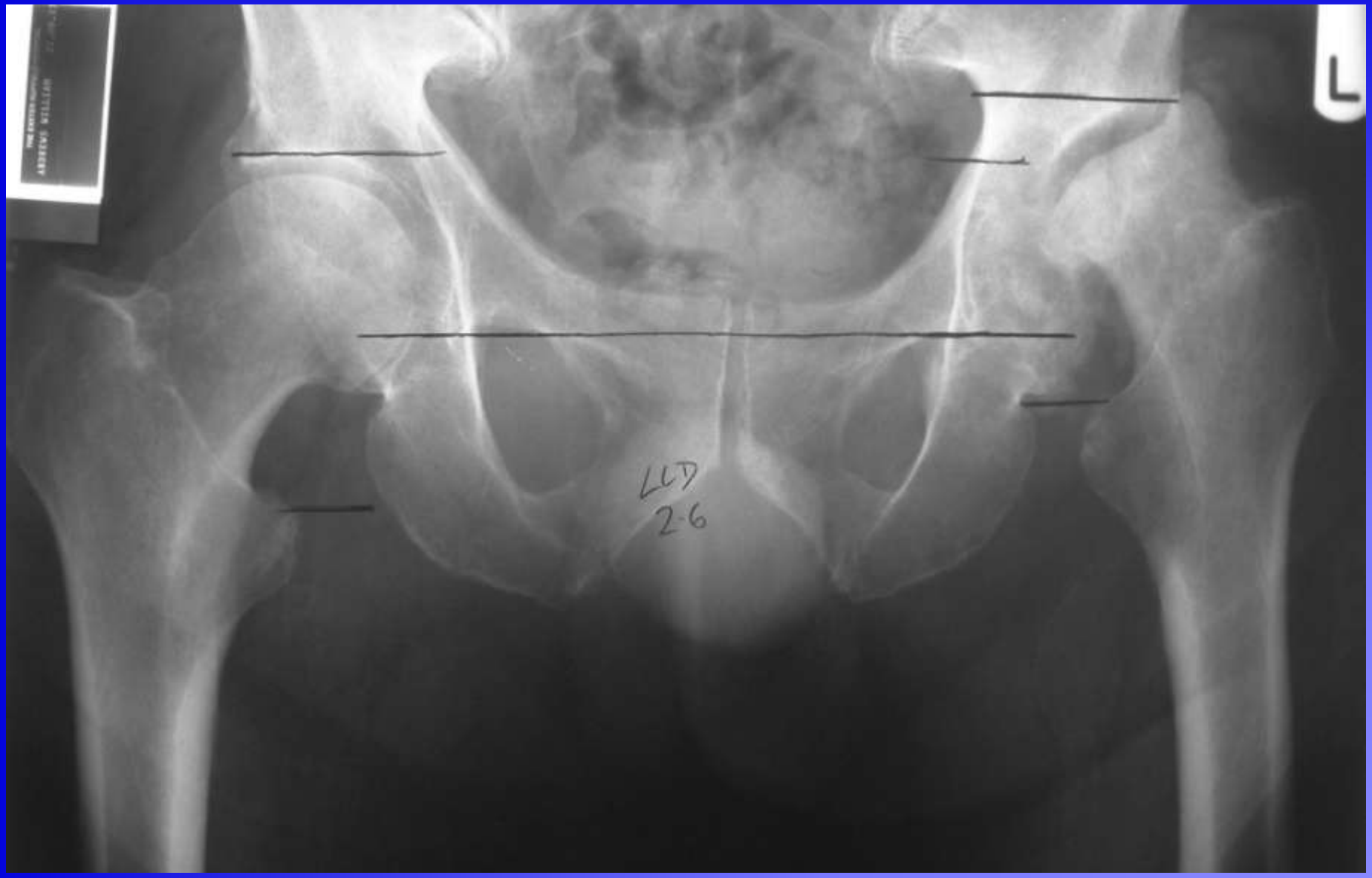
1. Assess bone defeciency or excess
2. Assess leg length
3. Establish Centre of Rotation of Acetabulum (CRA)
4. Establish CR of Head (CRH)
5. Offset (CRH to neutral axis)
6. Stem size
7. Neck resection level

Bone deficiency or excess

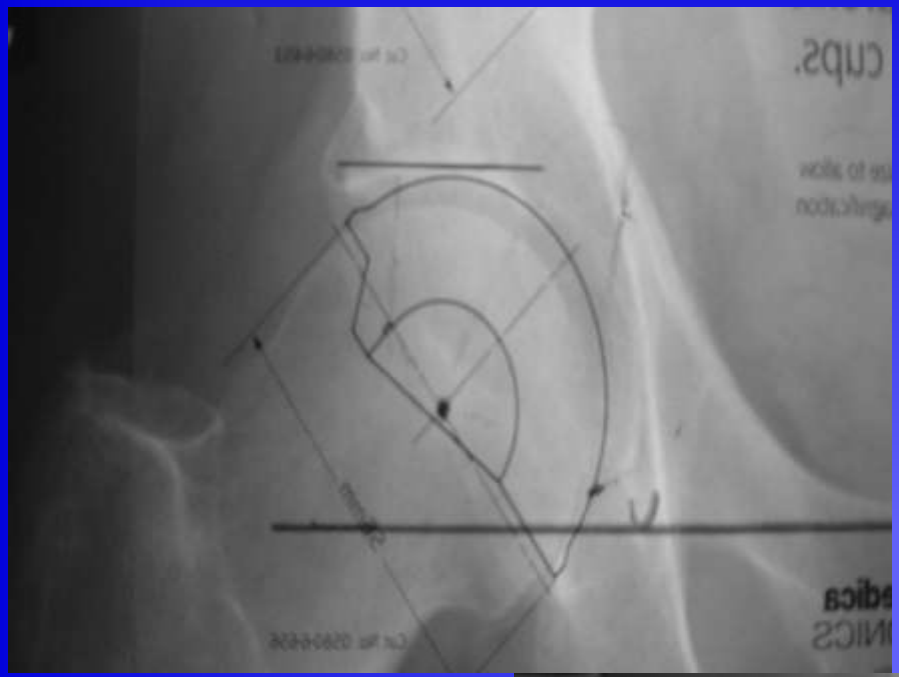
- Location
- Contained v uncontained
- Options
- Requirements
  - Prostheses
  - Bone graft

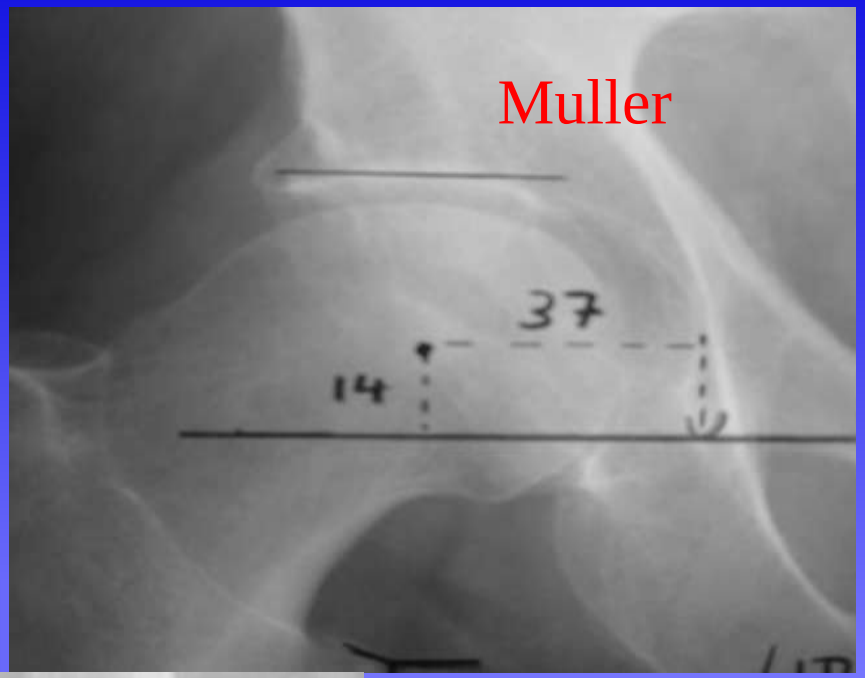


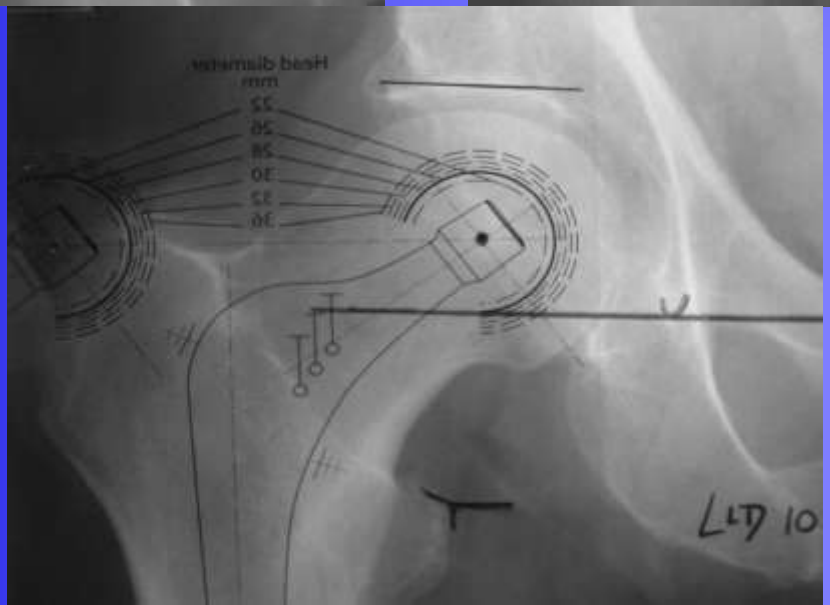
X rays - LLD



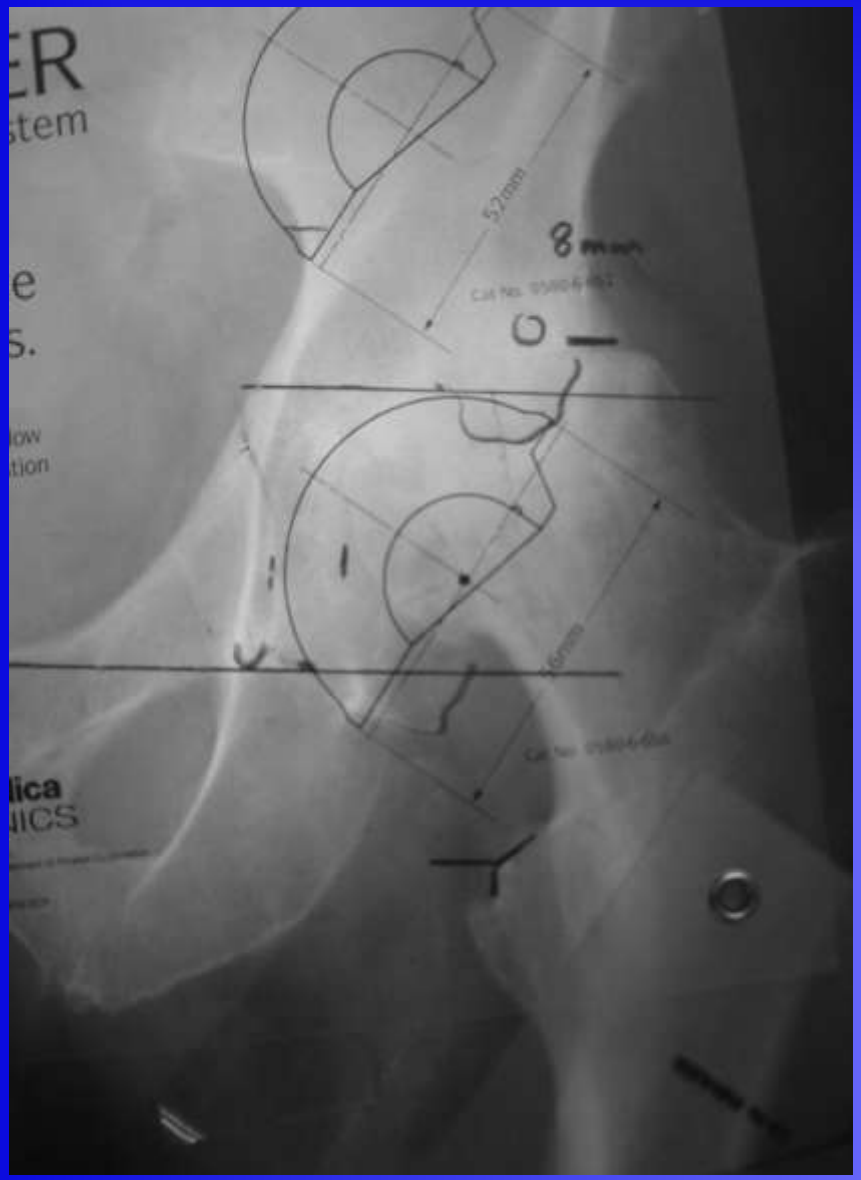
Centre of Rotation of Acetabulam / Head



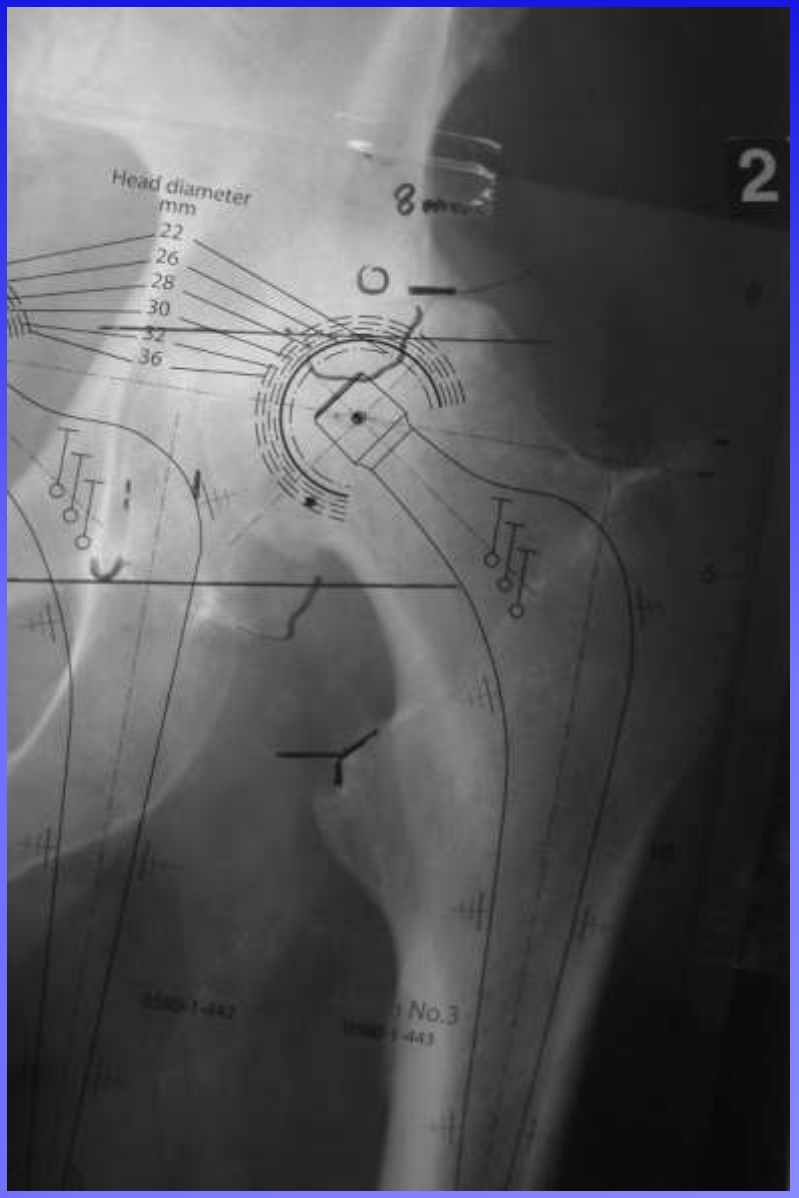


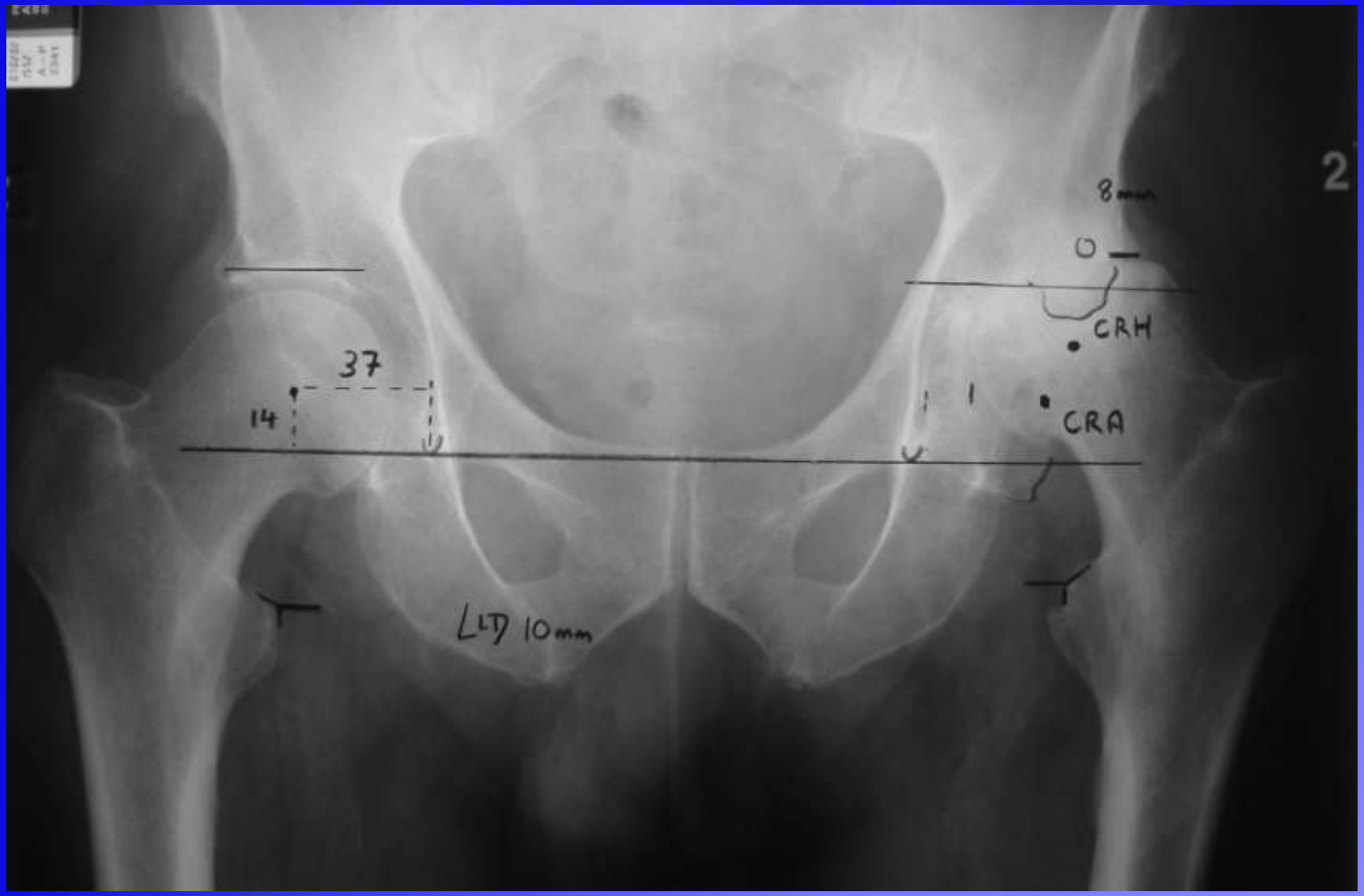


CRA

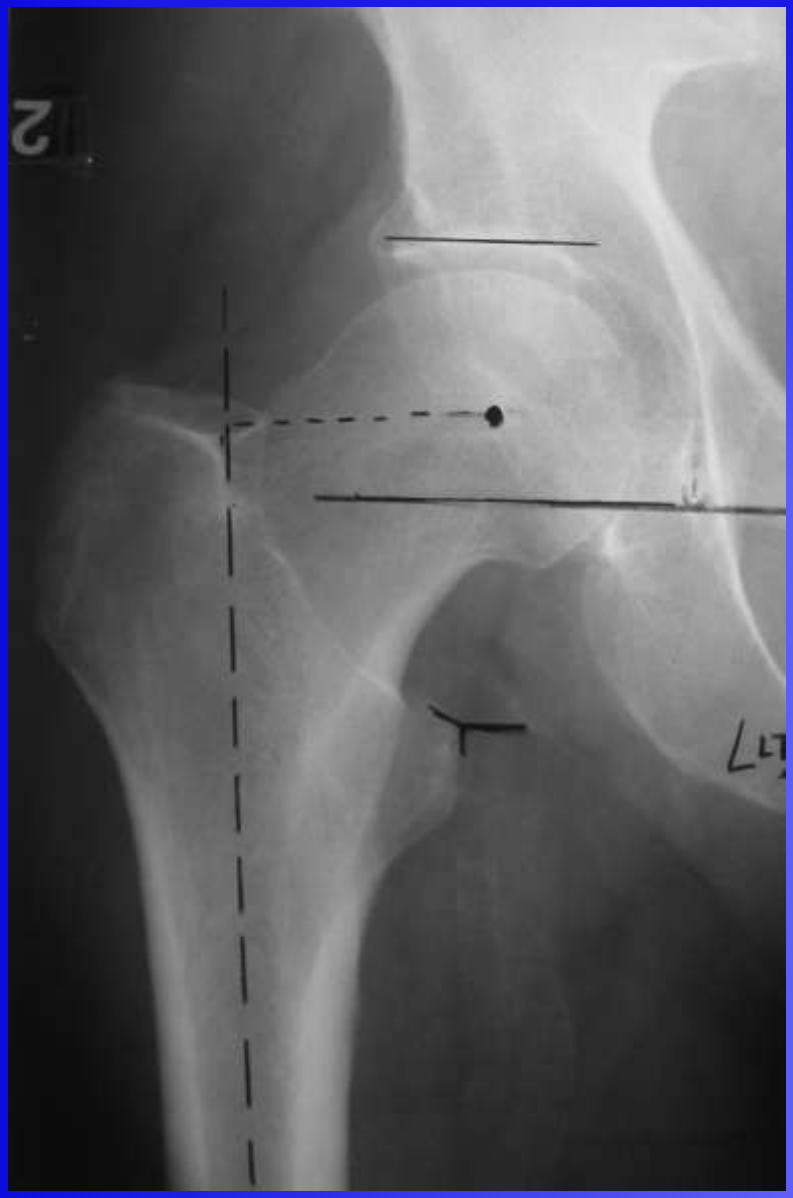


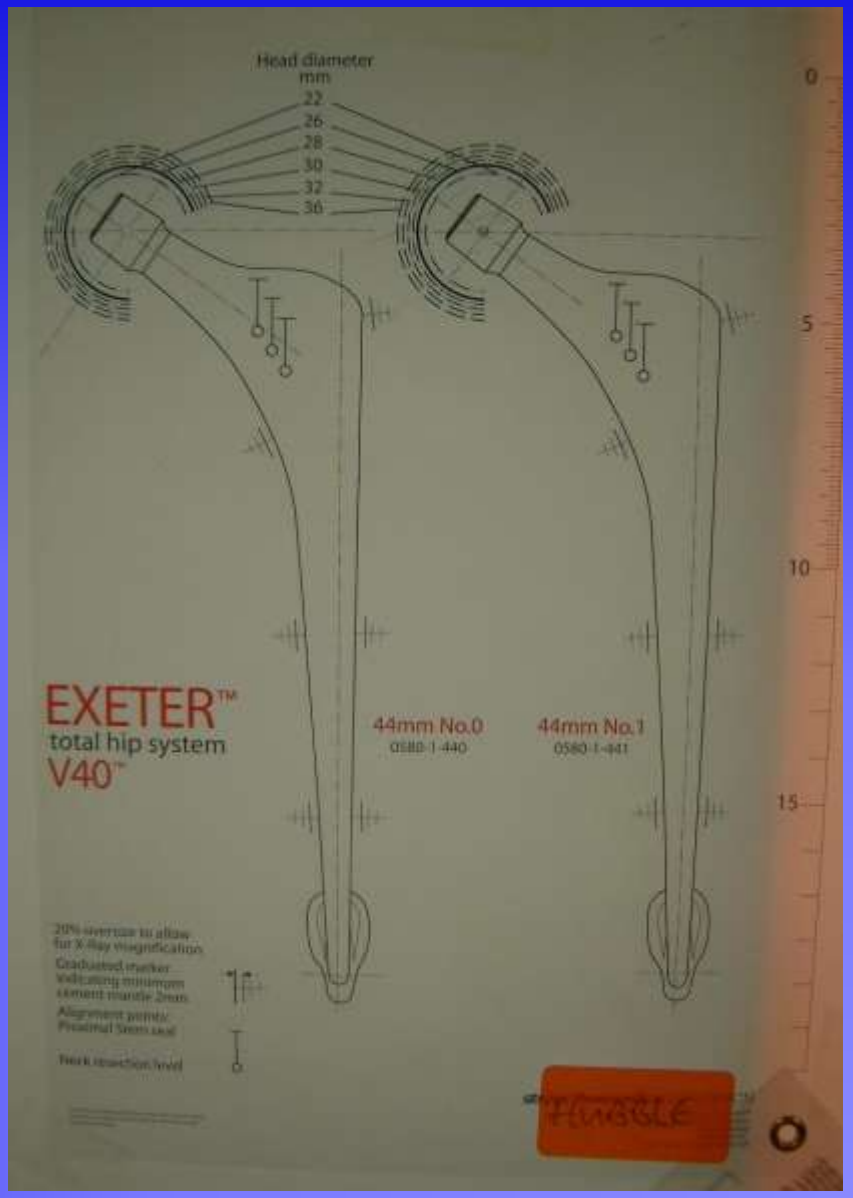
CRH



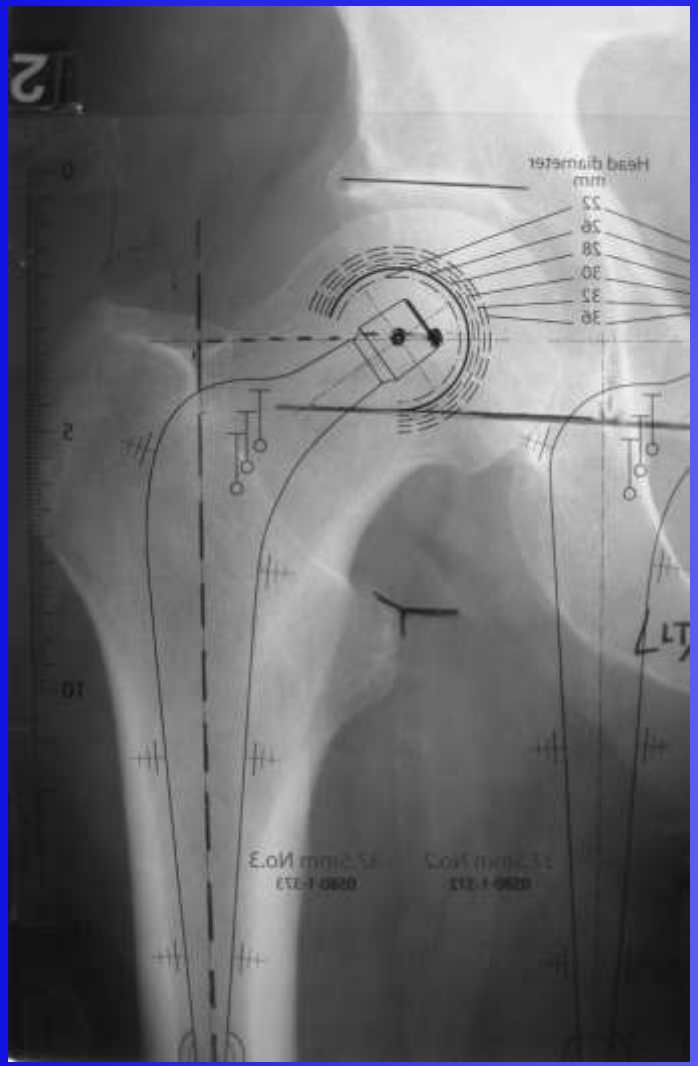

8mm
CRH
37
14
1
CRA
LLD 10mm

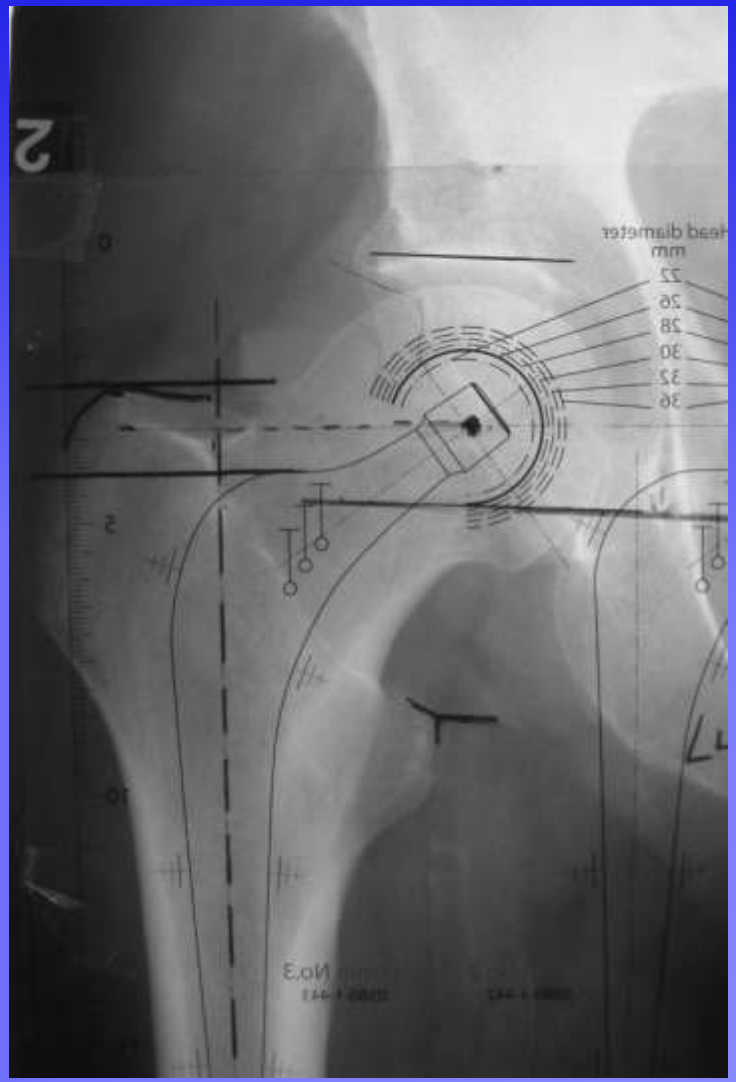
Offset and stem size





Offset and stem size

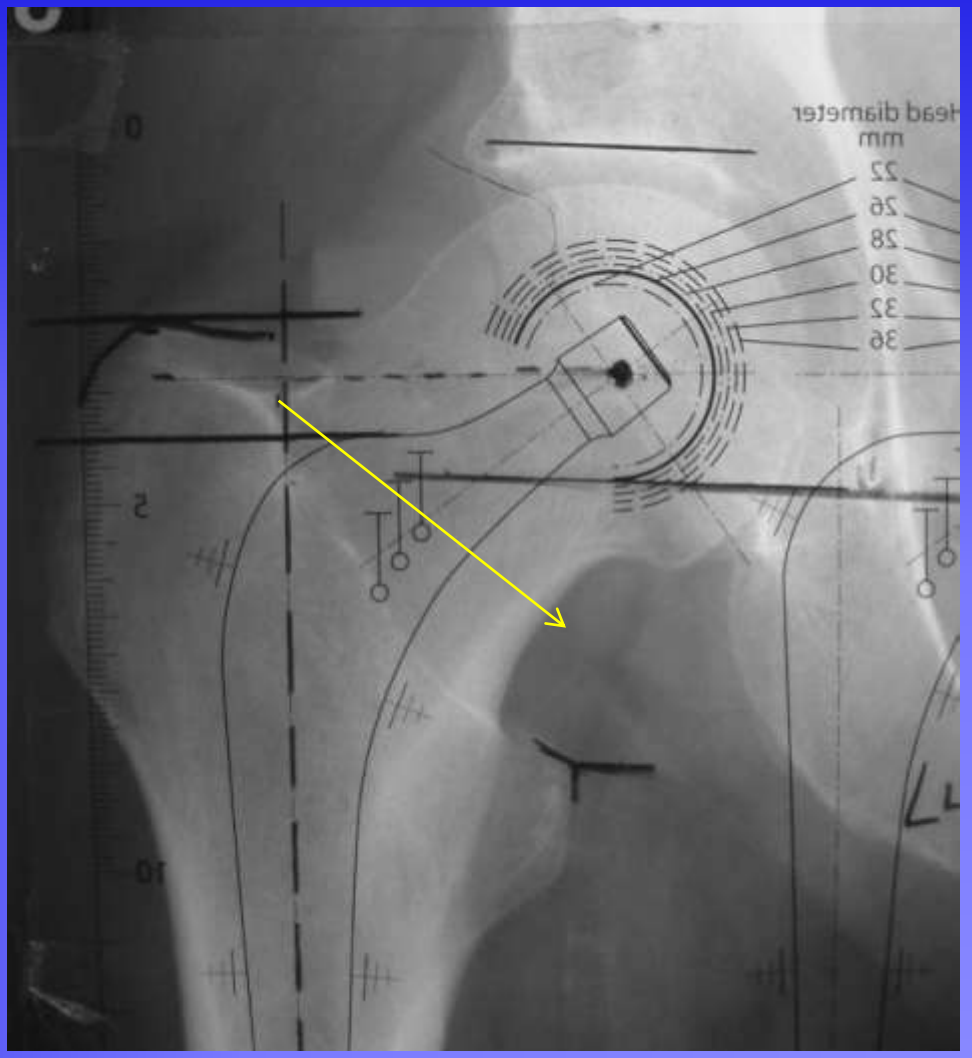




X rays – Neck resection level

- Collarless stem
  - Not critical

- Collared stem
  - Determine level of resection of neck and mark it



X-rays

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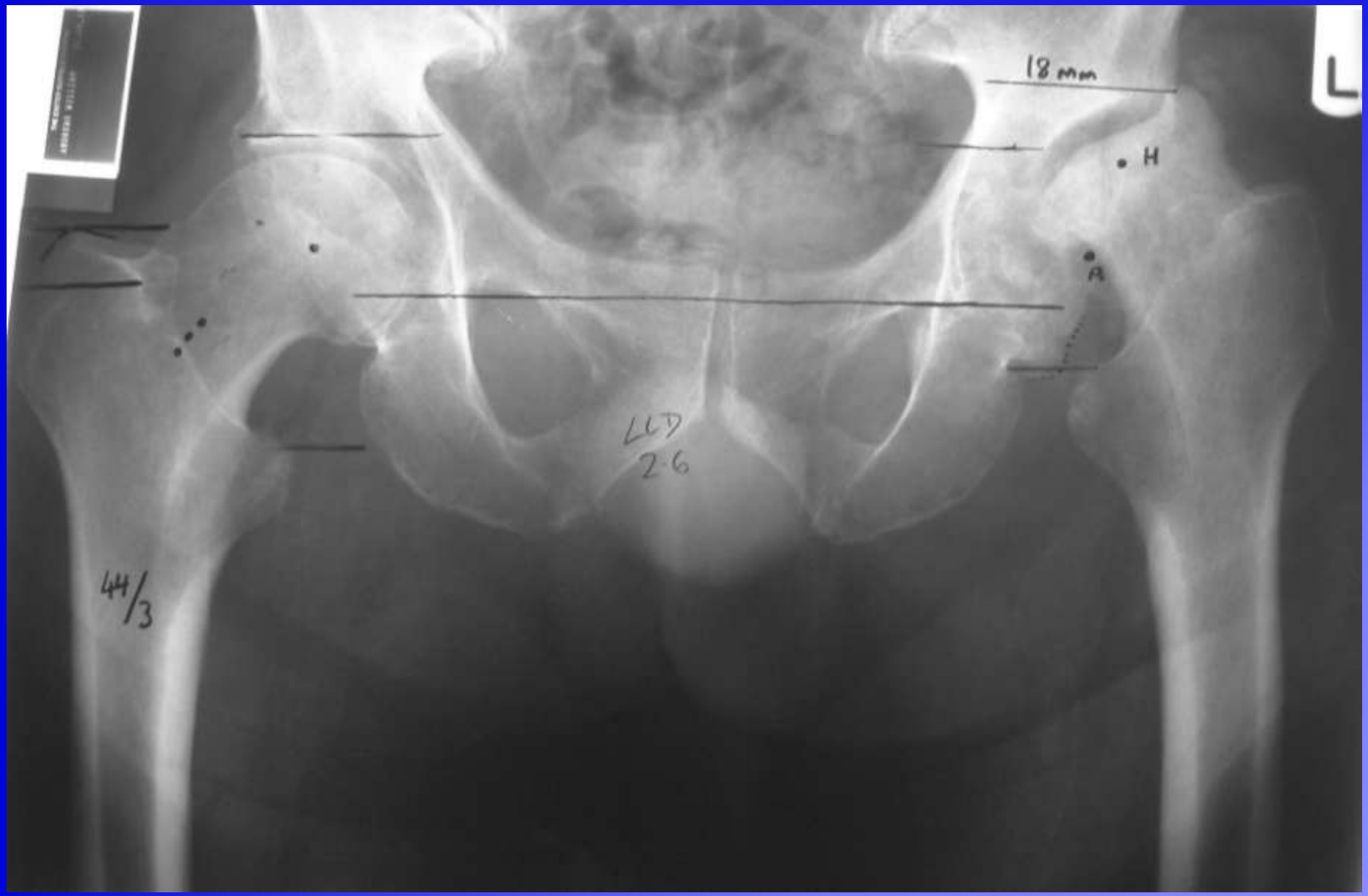
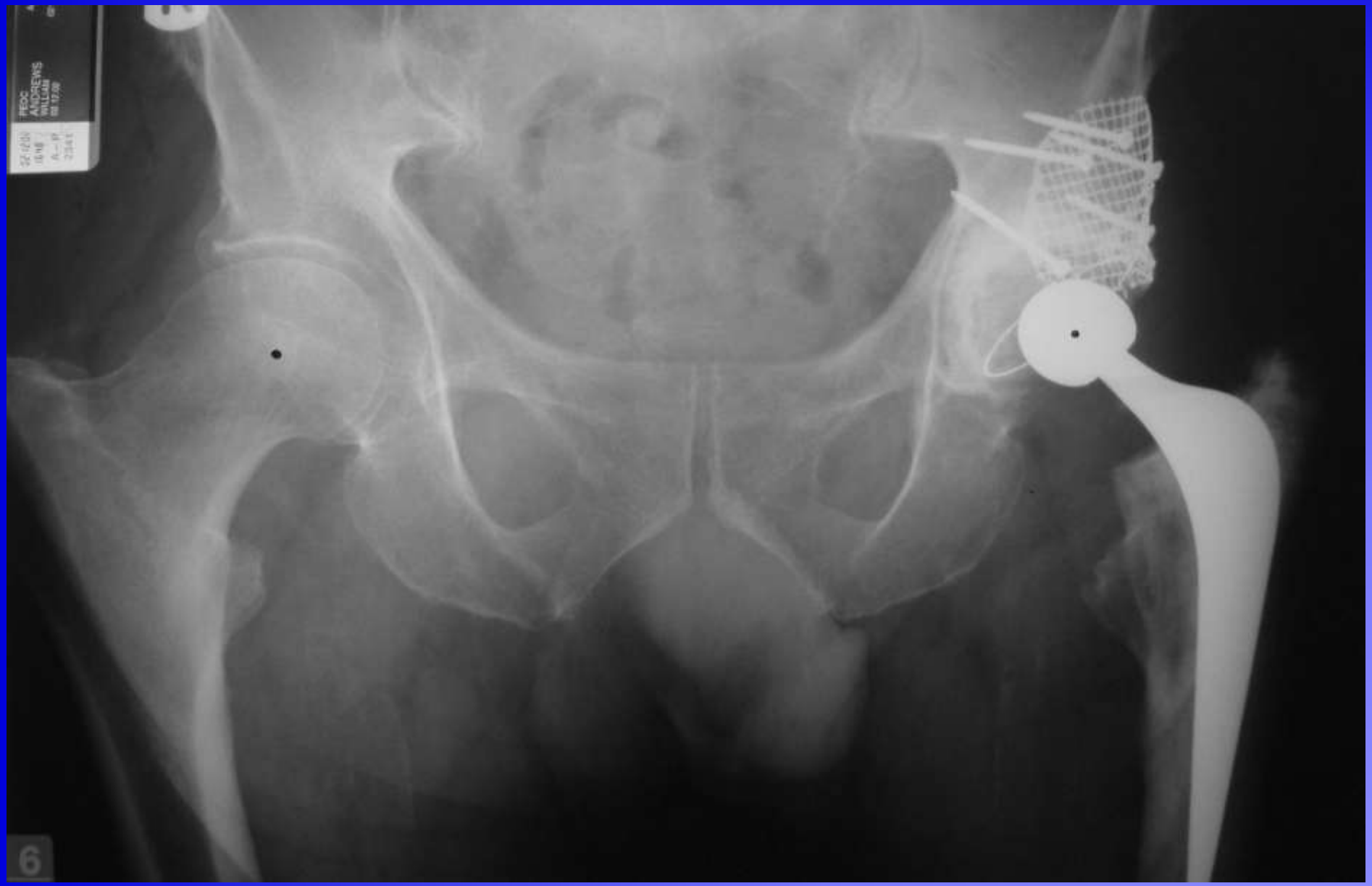
Complex Primary Templating



Complex Primary – Post reconstruction



Templating for Revisions

- **Principles are the same as for primary**
- **Have a Plan A and Plan B / C based on "What if"**

- **Additional planning would vary on type of reconstruction (ie bone graft / augments, circlage wires, struts, etc)**

- **Cortical lesions which erode >50% of cortex in AP and Lateral view should be bypassed.**

- **Avoids a prolonged procedure and intraop disastrous situations**

Digital Templating

- PACS has replaced hard copies of xrays
- Digital images cannot be templated with acetate templates
- Various sofware available for digital templating such as Traumacad, Orthoview, Orthopilot, etc.
- Incorporated into the PACS making templating seamless
- Follow 4 stages +/- additional post op module

Digital Templating – software wizard

- Scaling – automatically scales for magnication
- Planning – identifies the bony land marks and detects LLD
- Templating – Recommends both the size and offset for the selected prosthetic implants
- Reporting – Completed plan is saved /archived in PACS and can be printed for future reference
- Some softwares even allow post op analysis (complex arithmetic calculation) module for the acetabular and femoral component orientation and position – Excel database

Digital Templating

Digital templating

1. Am J Orthop (Belle Mead NJ). 2011 Aug;40(8):395-8.

   Accuracy of digital templating in total hip arthroplasty.

   Whiddon DR(1), Bono JV, Lang JE, Smith EL, Salyapongse AK.

   Naval medical Centre, Portsmouth, USA

Concluded “improved accuracy over traditional acetate templating”

2. J Surg Orthop Adv. 2013 Summer;22(2):148-51.

   Accuracy and reliability of digital templating in primary total hip arthroplasty.

   Pullen WM(1), Whiddon DR.

Accuracy	Acetate	Digital
Femoral	80 %	74 %
Acetabular	96 %	93 %

Concluded “Digital templating is safe and effective for preoperative planning for THA.

Acetate vs Digital

- Can J Surg. 2009 Feb;52(1):6-11.

  Digital versus conventional templating techniques in preoperative planning for total hip arthroplasty.

  Kosashvili Y(1), Shasha N, Olschewski E, Safir O, White L, Gross A, Backstein D.

  Division of Orthopaedic Surgery, Mount Sinai Hospital, University of Toronto,

- 18 patients , initial acetate templating and then digital templating

- Intra-and interobserver variability was satisfactory for both templating techniques. There was no significant difference in the performance of the 2 techniques in predicting final component selection during surgery.

CONCLUSION:

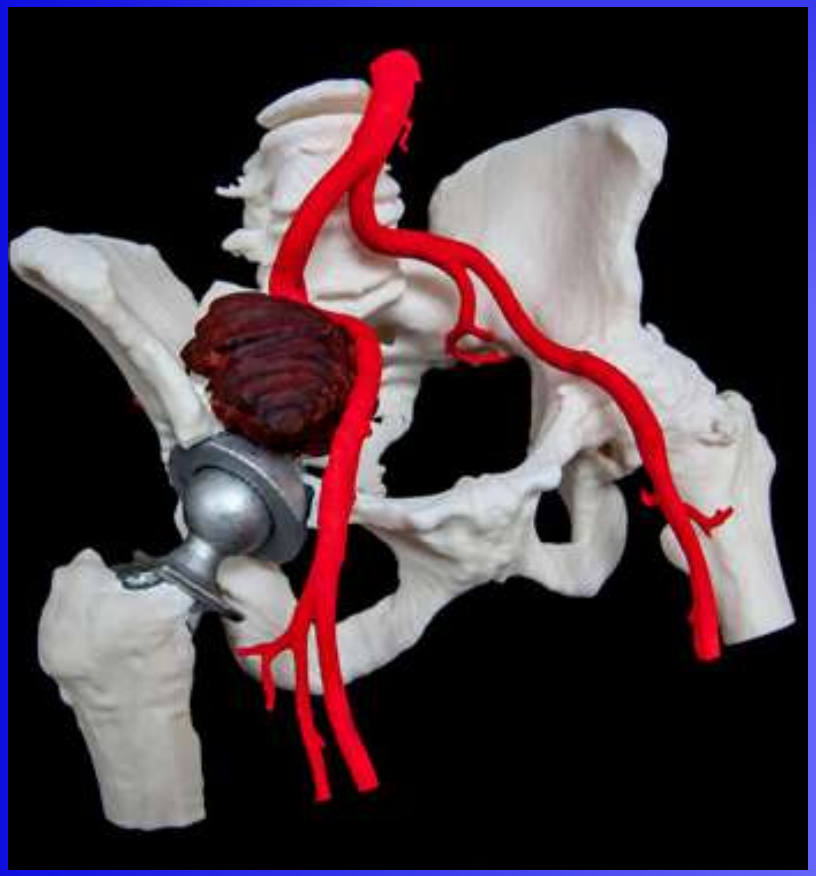
"Digital preoperative templating is as reliable as conventional templating techniques"

Acetate vs Digital

- J Arthroplasty. 2009 Feb;24(2):175-9.
  A comparison of acetate vs digital templating for preoperative planning of total hip arthroplasty: is digital templating accurate and safe?
  Iorio R(1), Siegel J, Specht LM, Tilzey JF, Hartman A, Healy WL.
  Department of Orthopaedic Surgery, Lahey Clinic Medical Center, Burlington, Massachusetts 01805, USA.
- 50 consecutive THR
  The absolute errors were larger for digital compared with acetate templating; however, mean absolute errors did not differ significantly

Conclusion: “Acetate and digital templating can accurately predict the size of THA implants. Digital templating was determined to be acceptably safe for preoperative planning of primary THA operations”

Future – 3D templating / Printing



Future – 3D templating

- Orthop Traumatol Surg Res. 2012 Apr;98(2):151-8.

- **Accuracy of the preoperative planning for cementless total hip arthroplasty. A randomised comparison between three-dimensional computerised planning and conventional templating**.
- Sariali E1, Mauprivez R, Khiami F, Pascal-Mousselard H, Catonné Y.
- Department of Orthopaedic Surgery and Traumatology, la Pitié-Salpétrière Hospital, 47-83 boulevard de l'Hôpital, Paris, France.

- "3D planning gives a higher accuracy than conventional 2D templating in forecasting the size of cup and the stem"

Pre operative planning Summary

- Introduction – why or the aim
- History
- Examination
- X – Ray assessment
  - Bone defeciency or excess
  - LLD
  - Centre of rotation of acetabulam / femoral head
  - Offset
  - Neck resection level
- Digital Templating – 2D
- Digital templating – 3D

“Prior preparation and planning prevents poor performance”

Thank you