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SCALING –
Radiographic Technique

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SCALING FOR DIGITAL X-RAYS

- As images become ‘filmless’.
- Current planning practices with acetate sheets become difficult or obsolete.
- When images are printed to film sometimes it is fit to film rather than at acquisition size.
- *Solution*: A surgical planning software application that uses digital templates and a mechanism for scaling the image.

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RADIOLOGY INPUT IS VITAL

- So Orthopaedic templating is accurate
- Calculating magnification is essential
- An object of known size is used
- Linearly measured in the Scaling stage of Orthoview
- It automatically calculates the pixels/mm
- Now uses this for all measures
- Giving an improved result

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Scaling the X-ray Image

Mandatory procedure in OrthoView. WHY?

The magnification of any bony area is never known.

Knowing the magnification factor is critical for matching the prosthesis to the bone it will be implanted into.

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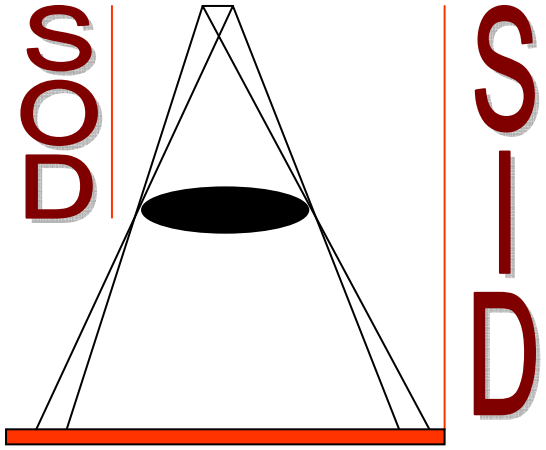
Scaling

Magnification factor is a product of the distance of the bony anatomy from the x-ray cassette and the diverging nature of the x-ray beam.

$$\text{Magnification \%} = \frac{\text{Source Image Distance}}{\text{Source Object Distance}} \times 100$$



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Scaling

- To accurately scale the anatomy the mechanism is therefore to place a radiopaque marker attached to or against the patient, in the plane of the joint or area of interest when the image is acquired.

- In OrthoView either Automatic *(Quickscale©)* or Manual scaling are available

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Scaling Issues 1……..

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- Radiology need to know which patients require scaling markers positioned on films.

  Solution: The Orthopaedics and Radiology departments need to discuss and determine how this will be achieved. For example added to patient requests for particular imaging examinations pre-operatively.

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Scaling Issues 2 ……

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- A Scaling Marker of choice needs to be obtained and distributed for use.

  Solution: The size in mm of the marker must be circulated to Orthopaedic surgeons. Markers are available from some Orthopaedic manufacturers, website based suppliers or an in house device can be used.

  Scaling Marker details follow……

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Scaling Issues 3

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- Positioning of markers is crucial for accuracy and staff training may be needed.

  Solution: Positioning guidance for a range of joints follows thereafter……

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Scaling Markers.

- Markers in the form of spheres or discs are best. Around 25mm in size has become the default standard.

- Those incorporating any linear aspect as shown below are best avoided as they are liable to positioning errors causing foreshortening on the resultant image, and hence an inaccurate reading. If used, they should be carefully placed parallel to the imaging plane or cassette.

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Radiographic Marker Selection

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OrthoView does not endorse any particular radiographic marker device.
The following are all widely available.

- Akucal calibration stand – www.j2medical.com

- Email: order@j2medical.com
  Tel: +1 412-573-6116

- A suction base with a flexible, extending arm holding a 25mm sphere. Suitable for vertical and horizontal use.

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Alternatively

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- Xemarc, LLC

  125 Chatham Hill

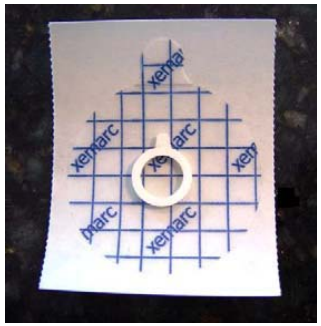
  South Glastonbury, CT 06073

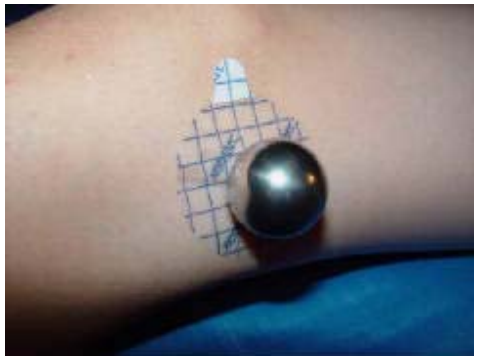
  T: +1 860-430 9019

  F: +1 860-652-9996

  E: info@xemarc.com

  www.xemarc.com
- Uses 25mm spheres which can be attached using sticky pads to the patient.
- Or the 20” gooseneck stand made of radiolucent material for positioning across the patient.





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Or another – UK developed

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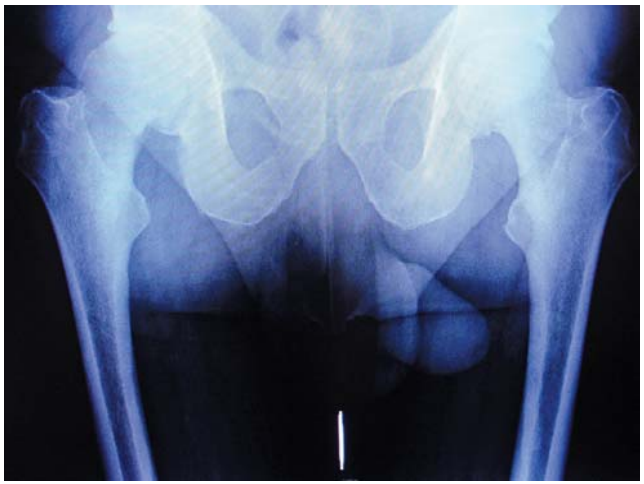
- **HipScaler –** www.hipscaler.com
- This device uses a 25mm disc, set in a perspex at four set heights. Ideal for hip and pelvis imaging.



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Another Option

- A low cost option is to use an agreed coin or disc of known size




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Positioning Guide for Markers

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- All positioning of markers shown is a guide to use and specific surgeons may require a particular joint or bony area to be marked according to their requirements.
- The devices shown can be replaced with alternative objects of known size.
- All objects used in a patient contact environment will need to be cleaned according to the local health and safety hygiene requirements with a suitable non-abrasive cleaning solution applied after each use.
- A selection of commonly examined body areas requiring marker placement follows……

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Positioning Guide for Markers

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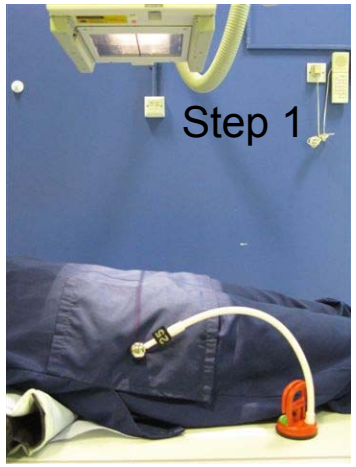
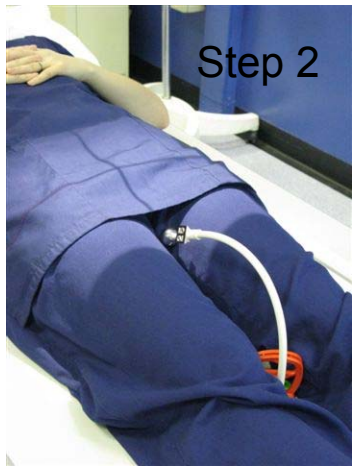
- PELVIS
  - Position patient to include upper 1/3 of femoral shaft on the pelvis image
  - There are 2 stages for marker positioning on the pelvis image.

    1. Position at the level of the greater trochanter on the lateral side of the pelvis, equivalent to the hip joint level. Unless the patient is narrow at the hip the marker will be projected beyond the margin of the image, therefore……
    2. Move the marker carefully to the same vertical height level between the thighs where it will be visible in the radiation field.





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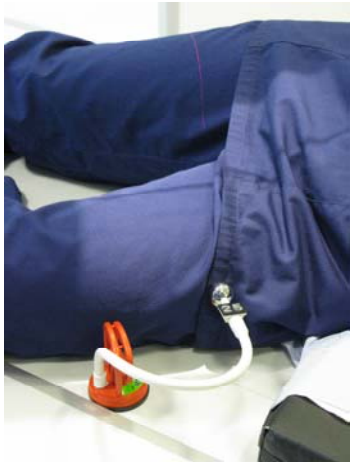
- HIP
  - **AP** Hip, same positioning as pelvis, at the vertical level/height of the greater trochanter on the lateral side of the hip. Include in the radiation field.
  - **Lateral Oblique** Hip, designed to view the femoral stem width rather than the hip cup which can be measured in the AP. The marker is placed laterally mid-thigh to best establish the level of the femoral shaft. For very large patients any adipose tissue will need to be taken into account.
  - **Lateral Inferior-Superior**, NOF# view. Marker is positioned anteriorly mid-thigh to establish femoral canal width only near position of marker.



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Positioning Guide for Markers

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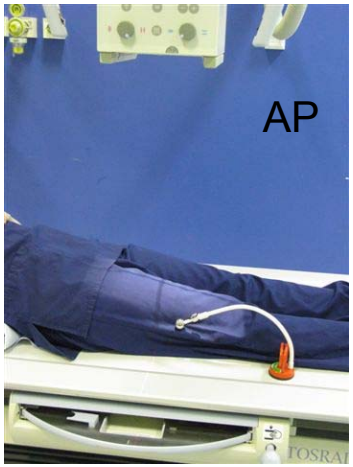
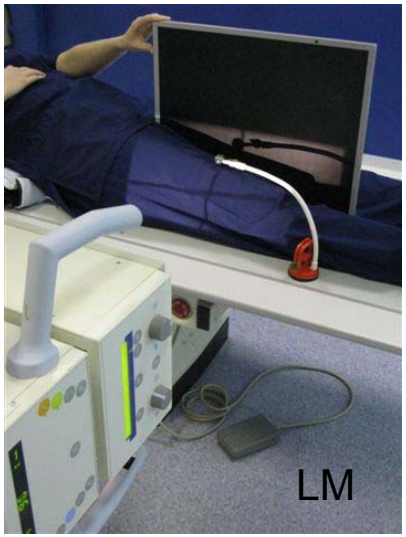
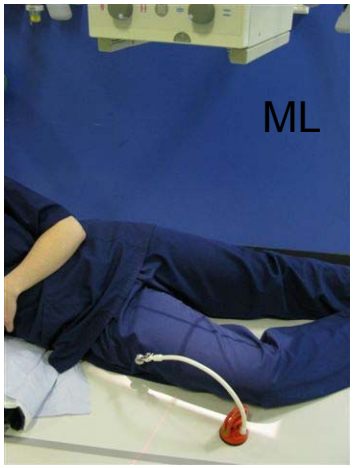
- LONG BONES, FEMUR etc.
  - **AP** View, place the marker midway between anterior and posterior surfaces over the shaft on the lateral side of the bone
  - **Lateral** View
    - **ML** - place the marker on the anterior part of the limb in the mid-line.
    - **LM** – place on the anterior mid-line of the limb around the area of interest if known.

      As the surgeon will need to know how the lateral was taken – annotate with horizontal beam or LM if possible.







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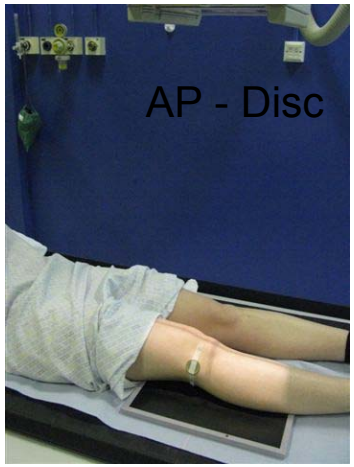

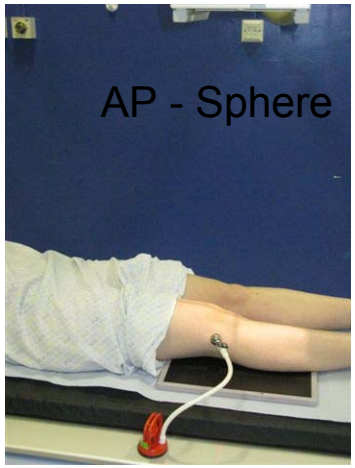

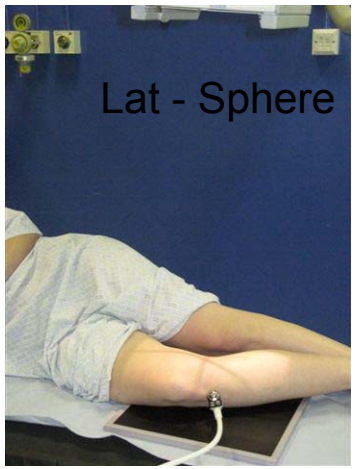

- KNEE
  - Position patient so an equal amount of femoral and tibial shaft are visible on the image.
  - **AP** View, marker is placed over the lateral side of the knee in the joint line, roughly midway between anterior and posterior surfaces, however if a patient is well muscled this needs to be considered.
  - **Lateral** (ML) View, marker is placed on the anterior side of the knee, either superior or inferior to patella in the midline
  - **Lateral** (LM) View, see Femur

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Positioning Guide for Markers

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- SHOULDER AP
  - Marker is placed on the lateral side of the humeral head at the mid-point between the palpable anterior and posterior bony prominences of the acromion to best define the humeral head.
  - A disc applied with surgical tape and a fixed sphere and arm device with suction base are shown.

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Positioning Guide for Markers

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- HUMERUS AP & LATERAL
  - **AP** View, marker is placed on the lateral part of the upper arm at the mid-point between the anterior and posterior side. Sphere and disc usage are shown.
  - **Lateral** View, marker is placed on the posterior side of the upper arm midway between the lateral and medial surfaces of the limb.

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Positioning Guide for Markers

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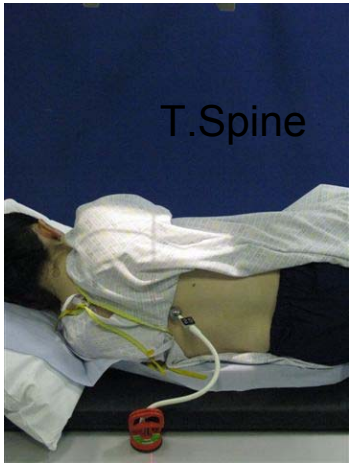
- SPINE
  - Cervical Spine, AP and Lateral
    - **AP** View, place marker on the lateral side of the neck over the midpoint between the anterior and posterior aspects of the neck.
    - **Lateral** View, place the marker over the cervical spinous processes on the posterior aspect of the neck.
  - Thoracic and Lumbar Spine
    - **Lateral** View, place marker over the spinous processes at the appropriate spinal level.
    - Note: an AP coned view does not allow marker placement, however for full length spine scoliosis images a marker can be placed on the lateral abdomen at spinal level of interest or some centres will prefer to use a ruler device.



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In Summary

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- Thanks goes to the Radiology staff of Queen Alexander Hospital, Portsmouth, UK for assisting us so generously with their time and patience in producing the positioning images. In particular Alice Mitchell, Radiographic Assistant & Sarah Davies, Senior 1 Radiographer.

- For further information on any aspects of this presentation please contact us at info@orthoview.com

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