DXA Scanning

Anatomy and Positioning

MRT Program

Serial Scans

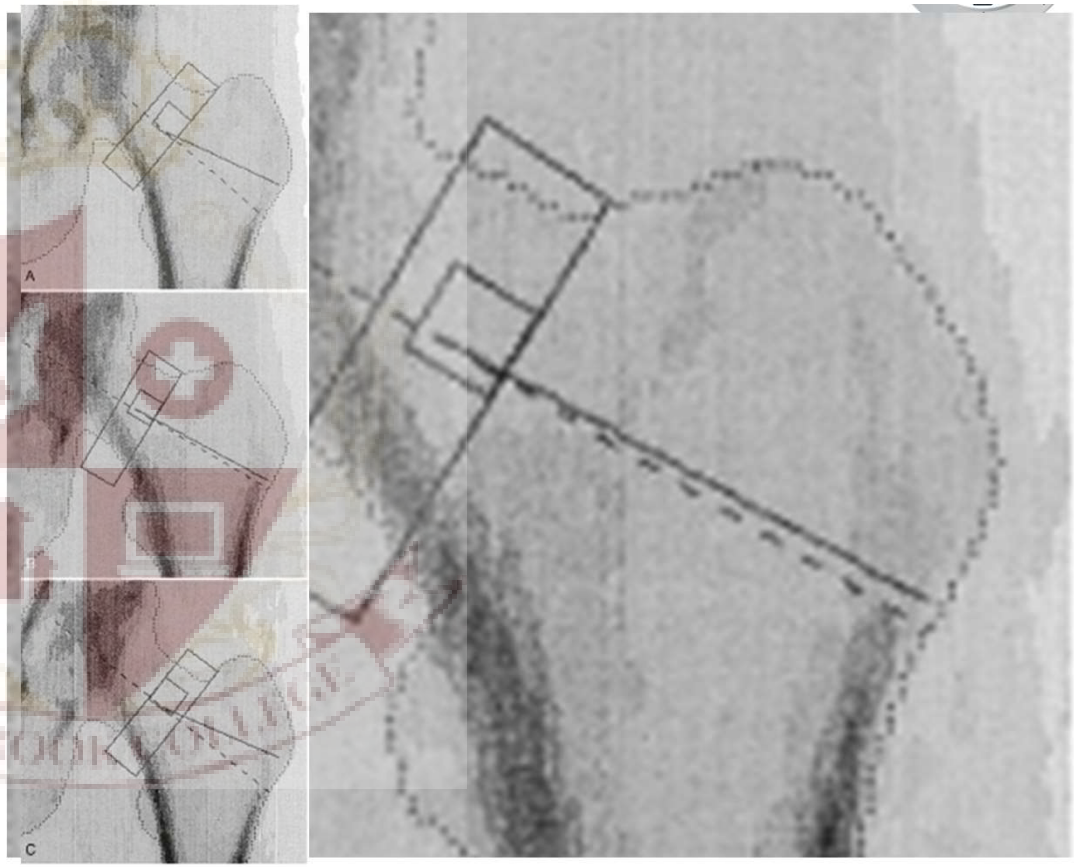
- Qualitative instrument used to monitor BMD change over time
- True comparison requires same scanner used and same positioning
- Scan settings ie. ROI, field size, mode, speed and current should be placed identically on images
- Ensures scan results comparable over time
- Baseline printouts should be available prior to scan

Examples of incorrect and correct follow up scan positioning

A. Baseline hip scan

B. Incorrectly positioned follow up scan. See size and shape of lesser trochanter and angle of femoral body do not match baseline

C. Correctly positioned follow-up scan



Lumber Spine

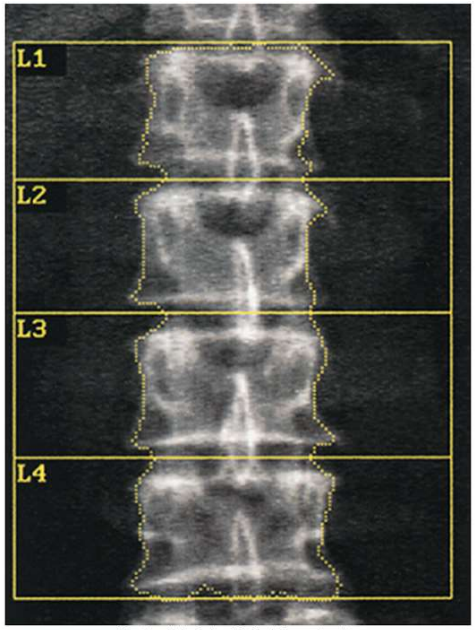
- Most appropriate for predicting vertebral fracture risk
- Spine
  - Supine
  - Midsagittal plane aligned to table
  - Lumbar spine centered in scan field
  - Some visualization of iliac crest should be seen

  to ensure all of L-4 included

  Iliac crest is excellent landmark for follow up scans

  -Ensure patient lying straight

  -Legs flexed at 60° to 90° to reduce lordosis-ensure to document height for future scans

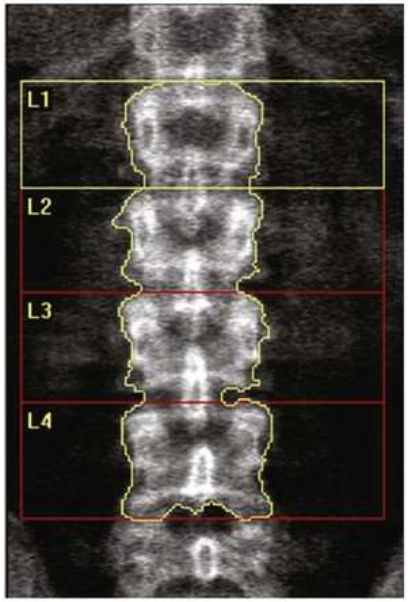


Courtesy Hologic, Inc., Bedford, Massachusetts.

L spine DXA Evaluation Criteria

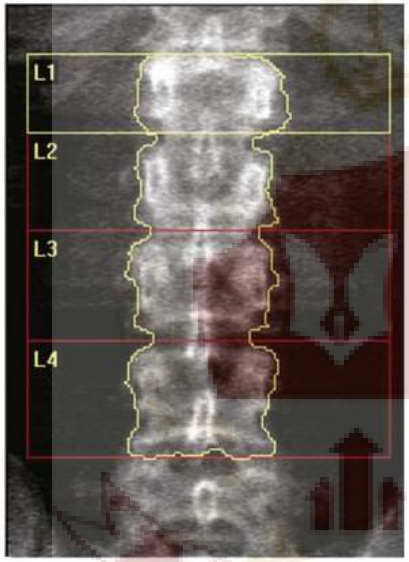
- Spine is straight and centered
- If scoliosis present equal soft tissue on with side of spine
- Scan contains a portion of iliac crest and half of T-12
- Artifact free
- Intervertebral markers properly placed
- Vertebral levels properly labelled
- Bone edges are correct

Compare Feature



A

Region	Area(cm²)	BMC(g)	BMD(g/cm²)
L1	13.56	10.07	0.743
L2	13.75	11.63	0.846
L3	14.56	11.83	0.812
L4	16.44	14.34	0.872
TOTAL	58.31	47.87	0.821



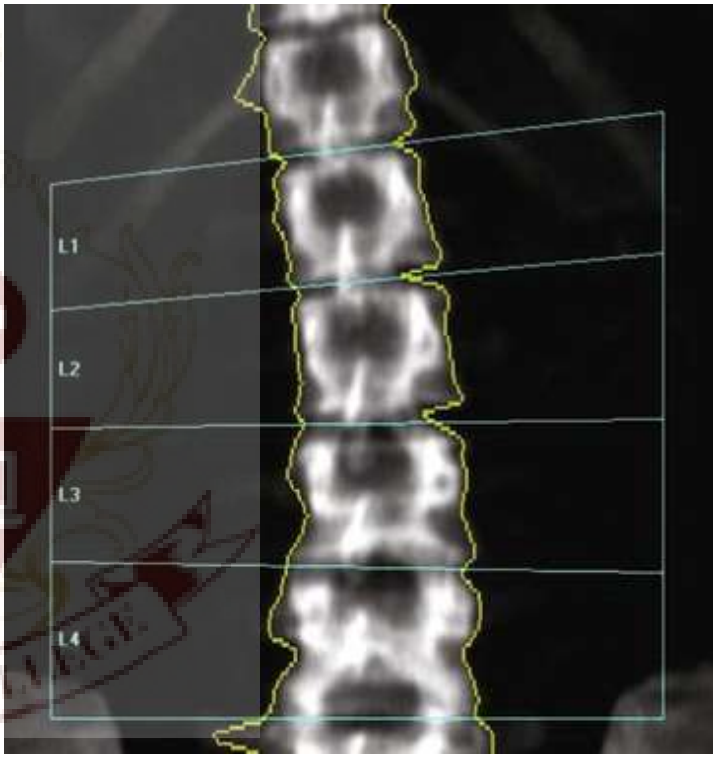
B

Region	Area(cm²)	BMC(g)	BMD(g/cm²)
L1	11.45	10.88	0.951
L2	12.97	11.72	0.903
L3	14.95	11.80	0.789
L4	16.50	14.35	0.870
TOTAL	55.87	48.75	0.873

- Indicates that L1 bone map and ROI from baseline scan (Image A) no longer fit follow up scan (Image B) because of compression fracture at L1
- Both scans should be analyzed to exclude L1 before comparing total BMD.

DXA Scoliosis present

- AP scan with scoliosis and scoliosis analysis technique
- L-5 may need to be off center to show equal soft tissue bilaterally



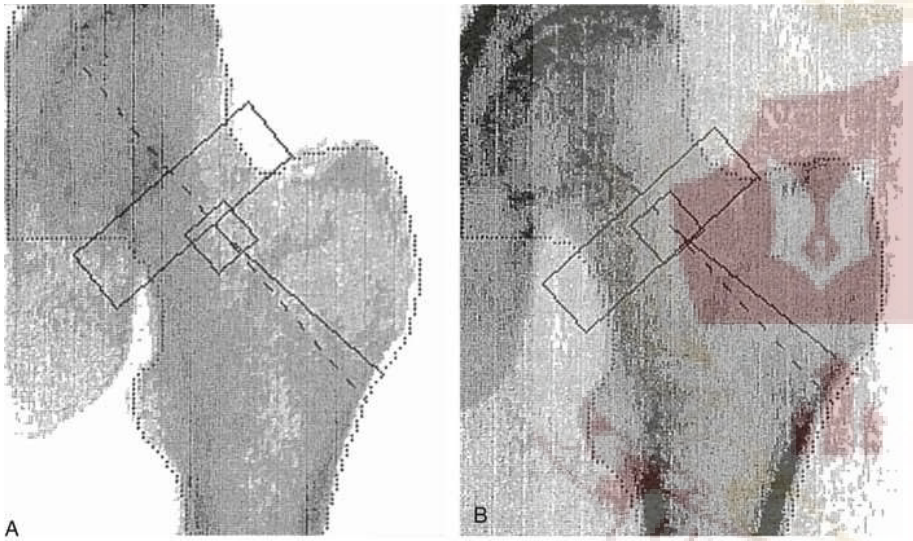
Proximal Femur DXA Scans

- To compare femur BMD over time the positioning must be exactly reproduced and angle of neck box ROI must be the same
- Lesser trochanter same size and shape- more rotation make lesser appear smaller
- Femoral shaft abducted to same
- The neck ROI is automatically placed perpendicular to the midline
- Manufacturers provide dual hip software
- If arthritis present, less affected hip should be scanned because of foreshortening of femoral neck and increased density in medial hip
- Fractured hip with orthopedic hardware should not be scanned
- DXA diagnosis always based on lowest BMD value

Proximal Femur DXA Scans

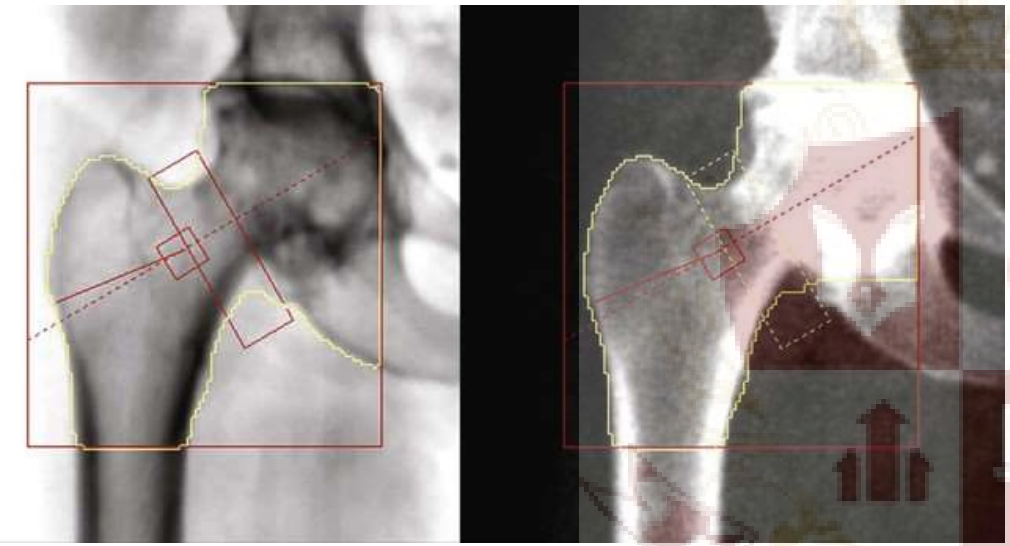
- Hip scan most important indicator of future hip fracture
- Most difficult to be precise because of variations in anato,y and the small ROI
- True AP hip positioning- 15 – 25 degree internal rotation
- Lesser trochanter is diminished in safe and only slightly visible
- Proper rotation when femoral neck is free from superimposition and appropriate pelvis separation seen
- Shaft of femur must be straight and parallel to long axis of table

Incorrect versus Correct Positioning



- Despite use of software tool to cut out ischium underlying femoral neck ROI. The BMC is increased, increasing the BMD
- Follow up scan one year later, pelvis is no longer rotated.
- Adequate space exists between the neck and ischium (not under ROI)
- Poor positioning of A
- Cannot compare for rate of bone loss
- Scan B would become new baseline

Hip Arthritis



- Note the increased density on the medial hip and foreshortened femoral neck
- Technologist may need to intervene in this situation
- Notation of difficulty positioning and known arthritis should be documented in patient history form

Forearm DXA Scanning

- Two important ROIs are present on these scans
- The ultradistal region (Colles fracture) and the one third (33%) region which measures an area that's primarily cortical bone near mid forearm
- Ulna is used for forearm measurement and always available for analysis, only radius is reported
- Noon dominant forearm is scanned- lower BMD than dominant
- Not scanned if history of fracture or internal hardware or severe deformity form arthritis
- Same chair is used for al patients to ensure consistency over Ulna measured from ulnar styloid to the olecranon process

Forearm DXA Scanning

- Distal one third of this measurement used to place the one third ROI (33% ROI)
- Forearm must be straight and centered to scan field
- Ensure patient comfort so no movement
- The placement of ultra distal ROI just below radial end plate
- Subject to low BMD

Checklist Good Femur Scan

- Lesser trochanter is small and barely visible
- Midline of femur is parallel to lateral edge of scan
- Adequate space present between ischium and femoral neck
- Midline of femoral neck is reasonably placed, reasonable angle for the femoral neck box
- Proximal, distal and lateral edges of scan field properly located

Forearm DXA Checklist

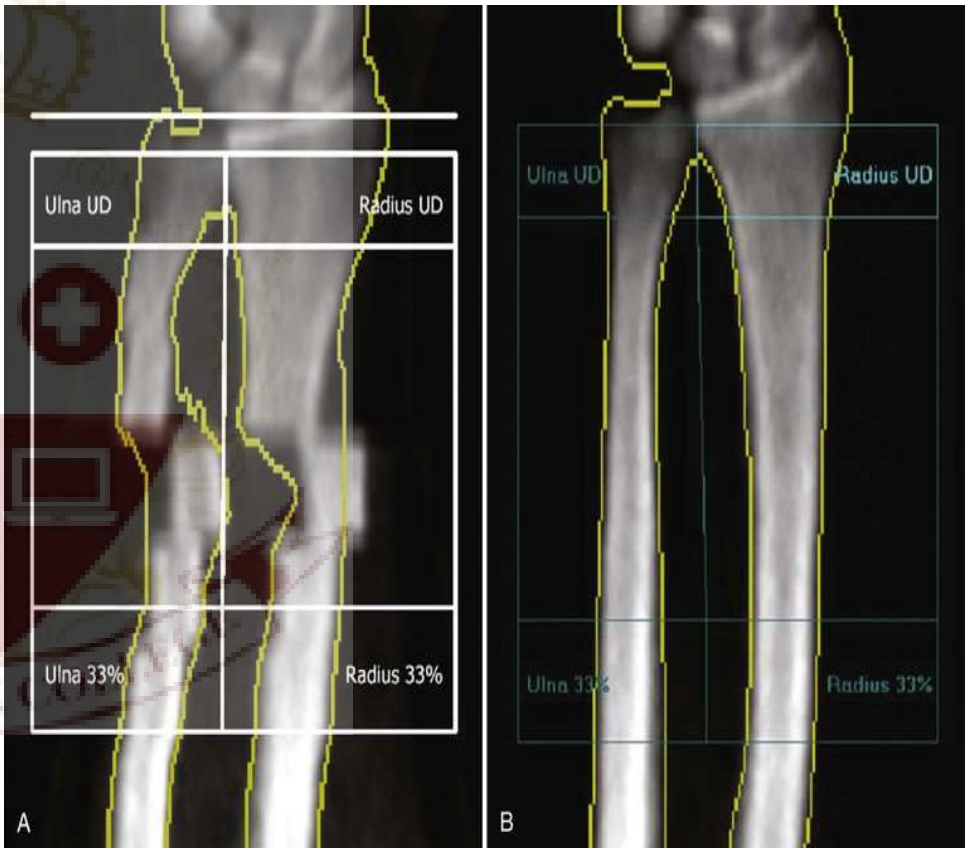
- Forearm straight and centered to scan field
- Adequate amounts soft tissue and air seen
- No motion present
- Proximal and distal ends of scan field placed correctly
- No artifacts seen

Conclusion

- Main purpose is to assist in diagnosis of osteoporosis detection of low bone mass
- DXA scans of hip and spine are mostly used but simpler peripheral scans are also available
- Technologists properly trained
- Knowledge of current treatments
- History taking and data input valuable tools

Forearm DXA Scanning

- A- forearm scan shows several positioning and acquisition mistakes
- Forearm is not straight or centered in the scan field
- Motion has occurred
- B-Shows good positioning, scan acquisition and scan analysis



Femur DXA Scans

- Challenges are very thin or thick patients and have very low bone mass
- Poor edge detection, mottled appearance of image