Dual-Energy X-ray Absorptiometry (**DXA**) Capabilities.

LECTURE 9

Learning Objectives

In this presentation we will discuss the capabilities of a Dual-Energy X-ray Absorptiometry (**DXA**) Scanner. This will include the:

- Basic areas that we scan:
  - Lumbar Spine and Hips
- Forearm.
- Total Body Composition Scan.
- Vertebral Fracture Assessment (VFA) AP total Spine.
- Orthopedic Analysis
- Atypical Femur Fracture Scan.
- Lateral lumbar Spine Scan with Bone Mineral Density (BMD) Results.

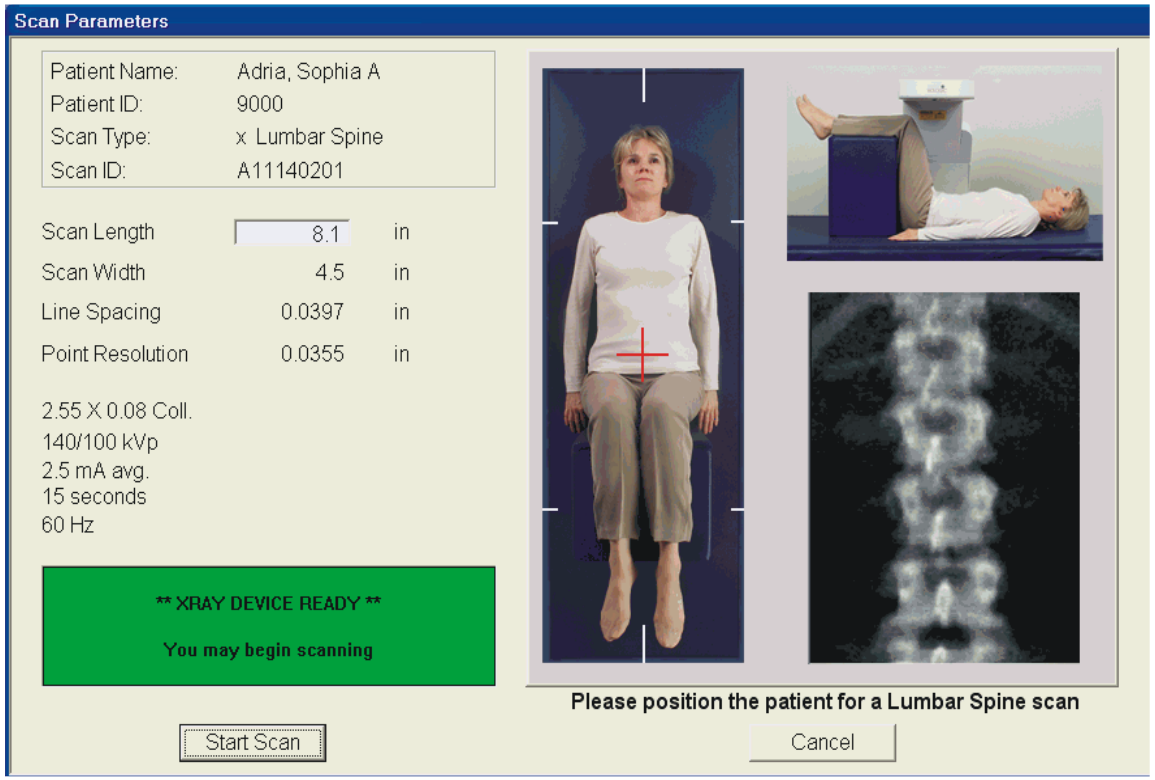
Dual-Energy X-ray Absorptiometry (**DXA**)

Is the gold standard in detecting bone density.

It is the gold standard because it covers very large diverse populations and has been around for a long time.

The areas that are generally scanned in a normal clinical setting are the hips and lumbar spine.

From the results of the hip and spine a bone density diagnosis is determined.



AP Spine Scan Positioning

Lie the patient on their back with their head at the right end of the table.

Make sure the patient is straight and lying flat.

Raise the patient's legs and place the positioning block under the legs.

Start the scan in the middle of L5. This is a couple inches below the navel at the top of the iliac crest.

AP Spine scan

In this scan we want to see all L1-L4.

Start the scan around the middle of L5.

End the scan at the middle of T-12.

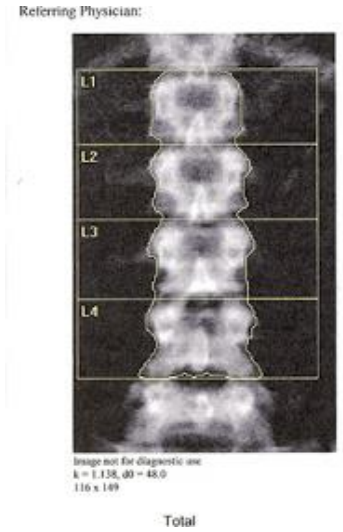
Make sure you have the transverse processes of L1-L4.

You should see the T-12 ribs.

Most of the time you should be able to see a small part of the iliac crest.

Ap Spine results

Left side GE Lunar/Right side is Hologic Reports



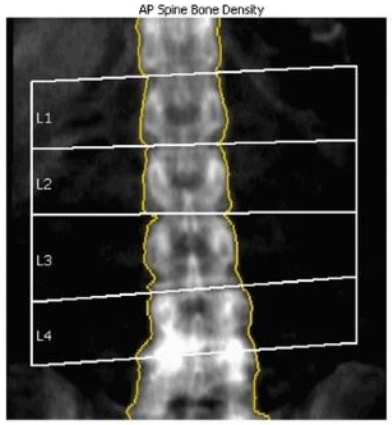
Scan Information:

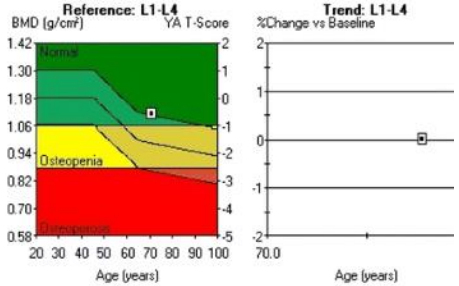
Scan Date: November 12, 2005 ID: A11120501
Scan Type: x Lumbar Spine
Analysis: November 12, 2005 09:48 Version 12.4:3
Lumbar Spine
Operator:
Model: Discovery C (S/N 81202)
Comment:

DXA Results Summary:

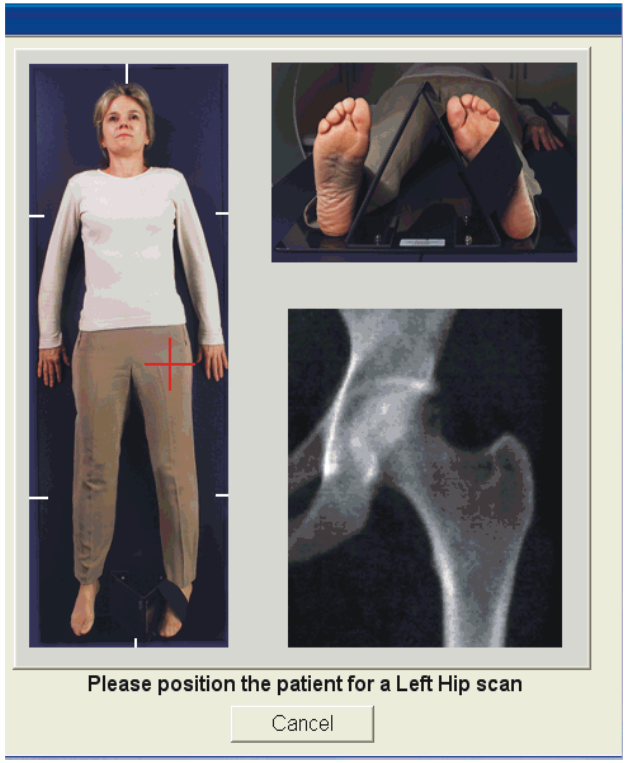
Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T-score	PR (%)	Z-score	AM (%)
L1	14.41	14.44	1.002	0.7	108	2.0	129
L2	15.27	16.33	1.069	0.4	104	1.8	123
L3	16.99	19.69	1.159	0.7	107	2.2	127
L4	18.74	21.27	1.135	0.2	102	1.8	121
Total	**65.41**	**71.72**	**1.096**	**0.4**	**105**	**1.9**	**124**

Total BMD CV 1.0%, ACF = 1.000, BCF = 1.000, TH = 3.855
WHO Classification: Normal





Region	BMD [1] (g/cm²)	Young-Adult [2] (%)	Young-Adult [2] T-Score	Age-Matched (%)	Age-Matched Z-Score
L1	0.913	81	-1.8	98	-0.2
L2	1.023	85	-1.5	102	0.1
L3	1.061	88	-1.2	105	0.5
L4	1.399	117	1.7	139	3.3
L1-L2	0.968	84	-1.5	101	0.1
L1-L3	1.003	86	-1.4	103	0.2
L1-L4	1.110	94	-0.6	113	1.0
L2-L3	1.044	87	-1.3	104	0.3
L2-L4	1.169	97	-0.3	116	1.4
L3-L4	1.231	103	0.3	122	1.9



Hip Scanning Position

Hip Scanning Instructions

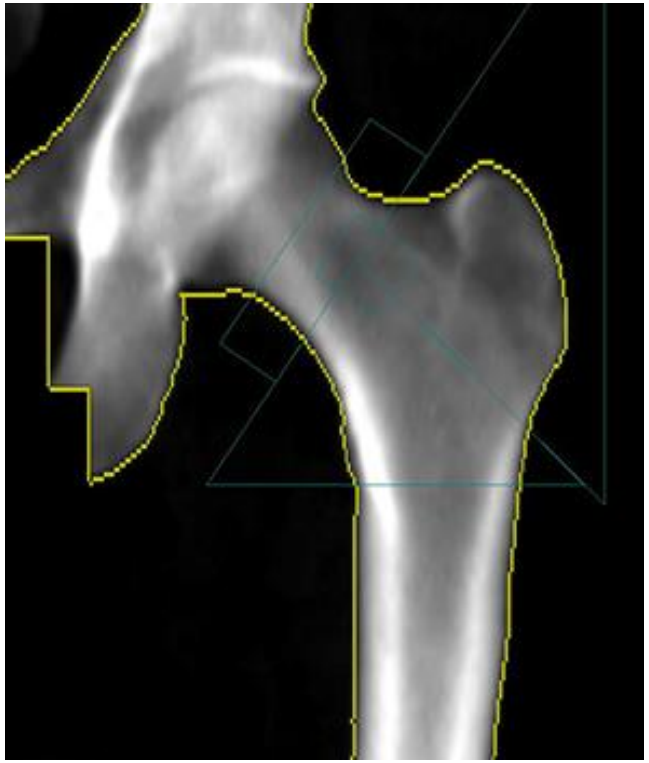
Lie the patient on their back on the table with their head at the right end of the table.

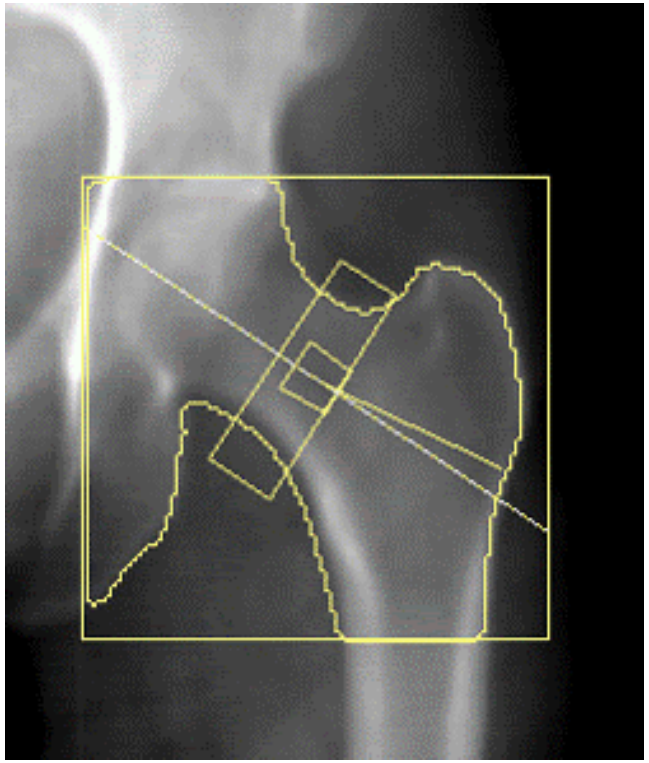
Place the **Foot Positioner** under the patient's legs and align the center of the positioner with the table and the patient's midline.

Rotate the patient's entire approximately 25 degrees inward.

Place the medial part of the foot against the positioner, put the strap around the lateral part of the foot, pull the strap tight and Velcro it to the other side of the positioner.

place the cross hair of the laser 3 inches below the greater trochanter and 1 inch medial to the shaft of the femur and start to scan.





Hip Scan

THIS IS WHAT A HIP SCAN LOOKS LIKE ON A HOLOGIC SCANNER (LEFT) AND A GE LUNAR (RIGHT)

An acceptable hip scan includes the following:

- The femoral shaft is parallel to the edge of the scan image.
- The greater trochanter is centered vertically in the window.
- The entire femoral head is visible.
- A 25° internal rotation of the hip showing minimal or no lesser trochanter on the scan image.

After Scanning the Hip.

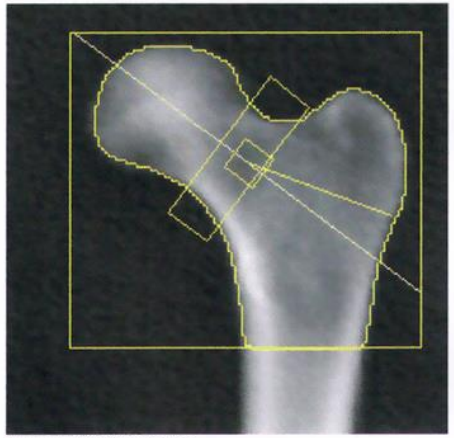


Image not for diagnostic use
k = 1.162, d0 = 61.6
101 x 91
NECK: -49 x 15

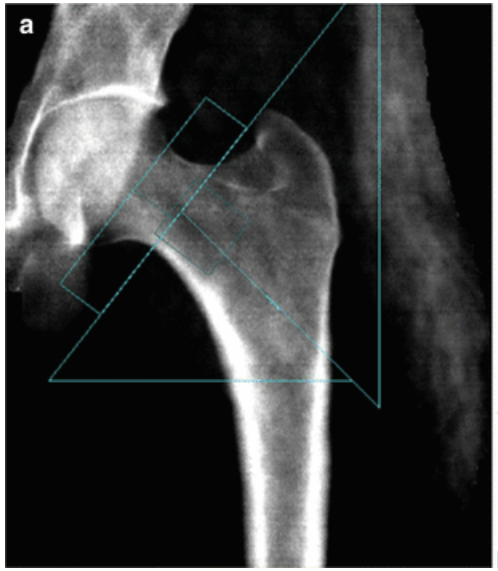
Scan Information:

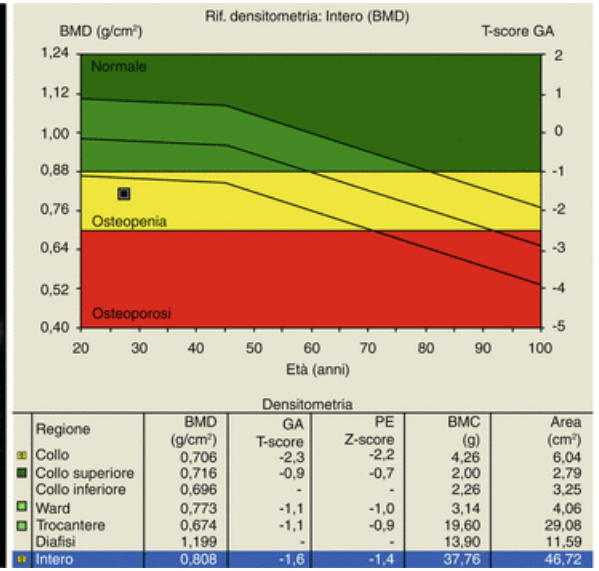
Scan Date: 23 May 2013 ID: K0523131R
Scan Type: a Left Hip
Analysis: 23 May 2013 17:39 Version 12.6:5
Left Hip
Operator:
Model: QDR 4500C (S/N 47998)
Comment:

DXA Results Summary:

Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T-score	PR (%)	Z-score	AM (%)
Neck	4.61	2.87	0.622	-2.0	73	-0.8	87
Troch	10.15	5.18	0.510	-1.9	73	-1.1	82
Inter	17.34	14.83	0.855	-1.6	78	-1.0	85
Total	**32.11**	**22.88**	**0.712**	**-1.9**	**76**	**-1.0**	**85**
Ward's	1.11	0.50	0.448	-2.4	61	-0.6	87

Total BMD CV 1.0%, ACF = 1.023, BCF = 1.011, TH = 1.136
WHO Classification: Osteopenia
Fracture Risk: Increased





Densitometria

Regione	BMD (g/cm^2)	GA T-score	PE Z-score	BMC (g)	Area (cm^2)
Collo	0,706	-2,3	-2,2	4,26	6,04
Collo superiore	0,716	-0,9	-0,7	2,00	2,79
Collo inferiore	0,696	-	-	2,26	3,25
Ward	0,773	-1,1	-1,0	3,14	4,06
Trocantere	0,674	-1,1	-0,9	19,60	29,08
Diafisi	1,199	-	-	13,90	11,59
Intero	0,808	-1,6	-1,4	37,76	46,72

Hip Results

LEFT HOLOGIC/RIGHT GE LUNAR

FRAX Risk Assessment Tool (FRAX ®)

The Fracture Risk Assessment Tool (FRAX) is a fracture risk calculator that estimates an individual's 10-year probability of incurring a hip or other major osteoporotic fracture.

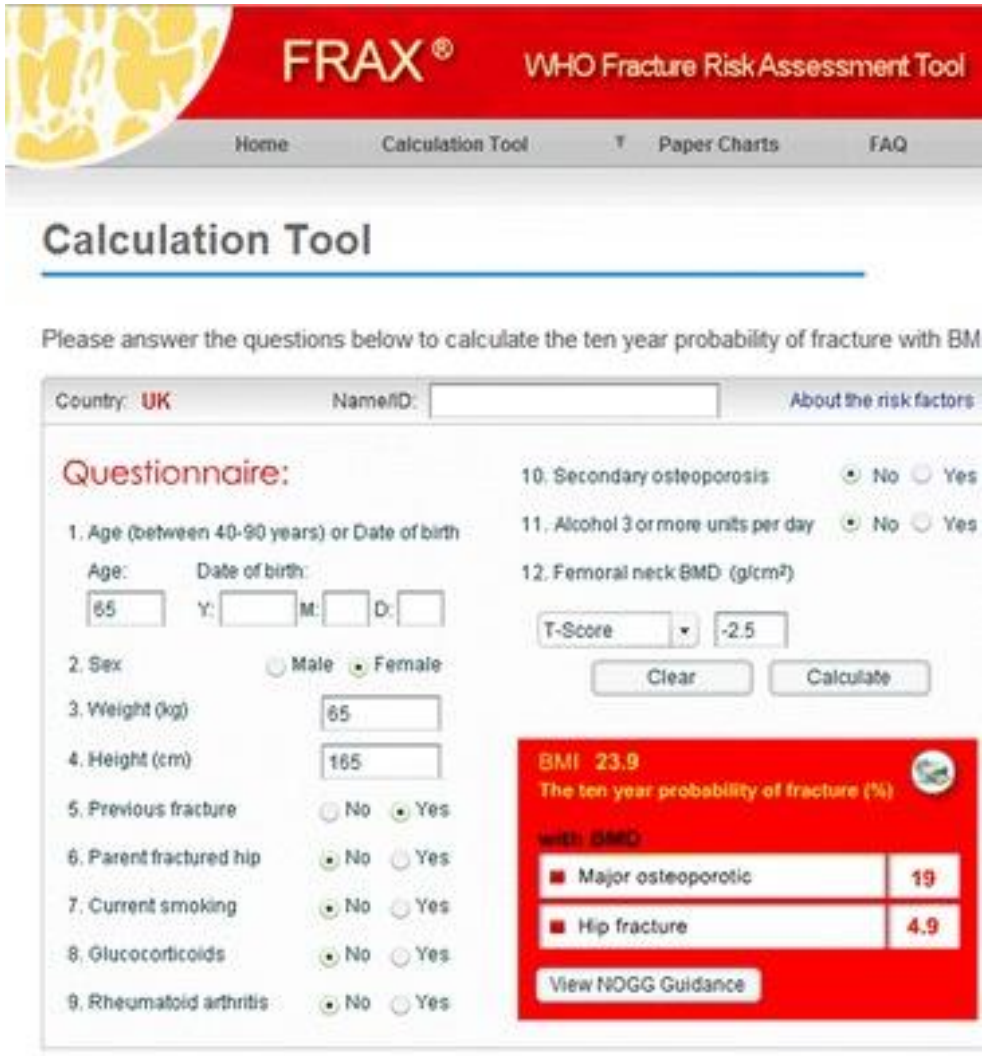
The FRAX® tool has been developed to evaluate fracture risk of patients. It is based on individual patient models that integrate the risks associated with clinical risk factors as well as bone mineral density (BMD) at the femoral neck.

Based on FRAX® calculations, patients are at high risk for fracture when they have a 3% or higher hip FRAX and a 20% or higher other major osteoporotic fracture.

This tool now comes with every bone density machine and has the ability to apply FRAX when activated.

Frax Risk factors

Age	The model accepts ages between 40 and 90 years. If ages below or above are entered, the programme will compute probabilities at 40 and 90 year, respectively.
Sex	Male or female. Enter as appropriate.
Weight	This should be entered in kg.
Height	This should be entered in cm.
Previous fracture	A previous fracture denotes more accurately a previous fracture in adult life occurring spontaneously, or a fracture arising from trauma which, in a healthy individual, would not have resulted in a fracture. Enter yes or no (see also notes on risk factors).
Parent fractured hip	This enquires for a history of hip fracture in the patient's mother or father. Enter yes or no.
Current smoking	Enter yes or no depending on whether the patient currently smokes tobacco (see also notes on risk factors).
Glucocorticoids	Enter yes if the patient is currently exposed to oral glucocorticoids or has been exposed to oral glucocorticoids for more than 3 months at a dose of prednisolone of 5mg daily or more (or equivalent doses of other glucocorticoids) (see also notes on risk factors).
Rheumatoid arthritis	Enter yes where the patient has a confirmed diagnosis of rheumatoid arthritis. Otherwise enter no (see also notes on risk factors).
Secondary osteoporosis	Enter yes if the patient has a disorder strongly associated with osteoporosis. These include type I (insulin dependent) diabetes, osteogenesis imperfecta in adults, untreated long-standing hyperthyroidism, hypogonadism or premature menopause (<45 years), chronic malnutrition, or malabsorption and chronic liver disease
Alcohol 3 or more units/day	Enter yes if the patient takes 3 or more units of alcohol daily. A unit of alcohol varies slightly in different countries from 8-10g of alcohol. This is equivalent to a standard glass of beer (285ml), a single measure of spirits (30ml), a medium-sized glass of wine (120ml), or 1 measure of an aperitif (60ml) (see also notes on risk factors).
Bone mineral density (BMD)	(BMD) Please select the make of DXA scanning equipment used and then enter the actual femoral neck BMD (in g/cm2). Alternatively, enter the T-score based on the NHANES III female reference data. In patients without a BMD test, the field should be left blank (see also notes on risk factors) (provided by Oregon Osteoporosis Center).


FRAX®
WHO Fracture Risk Assessment Tool
Home
Calculation Tool
Paper Charts
FAQ
Calculation Tool
Please answer the questions below to calculate the ten year probability of fracture with BM
Country: UK
Name/ID:
About the risk factors
Questionnaire:
1. Age (between 40-90 years) or Date of birth
Age:
Date of birth:
65
Y:
M:
D:
2. Sex
Male
Female
3. Weight (kg)
65
4. Height (cm)
165
5. Previous fracture
No
Yes
6. Parent fractured hip
No
Yes
7. Current smoking
No
Yes
8. Glucocorticoids
No
Yes
9. Rheumatoid arthritis
No
Yes
10. Secondary osteoporosis
No
Yes
11. Alcohol 3 or more units per day
No
Yes
12. Femoral neck BMD (g/cm²)
T-Score
-2.5
Clear
Calculate
BMI 23.9
The ten year probability of fracture (%)
with BMD
Major osteoporotic
19
Hip fracture
4.9
View NOGG Guidance


FRAX®
WHO Fracture Risk Assessment Tool
Home
Calculation Tool
Paper Charts
FAQ
Reference
alculation Tool
se answer the questions below to calculate the ten year probability of fracture with BMD.
untry: US (Caucasian)
Name/ID:
About the risk factors
uestionnaire:
Age (between 40-90 years) or Date of birth
Age:
Date of birth:
Y:
M:
D:
Sex
Male
Female
Weight (kg)
Height (cm)
Previous fracture
No
Yes
Parent fractured hip
No
Yes
Current smoking
No
Yes
Glucocorticoids
No
Yes
Rheumatoid arthritis
No
Yes
10. Secondary osteoporosis
No
Yes
11. Alcohol 3 or more units per day
No
Yes
12. Femoral neck BMD (g/cm²)
Select DXA
Clear
Calculate

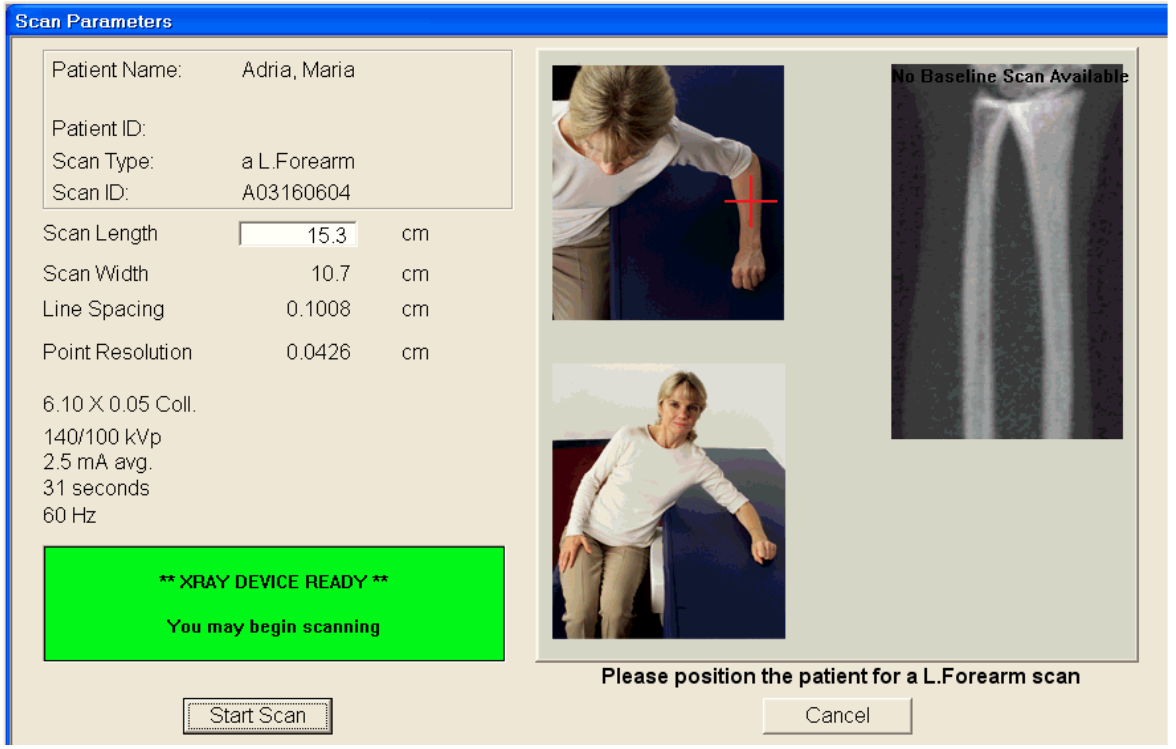
Forearm Scan

Reasons a Forearm scan is performed:

- There is more than one standard deviation difference between the hip and the spine scans.
- The degenerative changes in the spine or hips significantly alters the results therefore, that area needs to be thrown out and anther area scanned.
- Hardware has been placed in the spine or hips altering the results therefore, those areas need to be disqualified from interpretation and the forearm added.
- The patient is suspected to have hyperparathyroidism.
- The patient exceeds the table weight capacity.

Forearm Positioning

GE Lunar



Hologic

Forearm Positioning Instruction.

Make sure the forearm is flat and not rotated!!!

Make sure you use the GE Lunar positioner when using a GE Lunar DXA scanner.

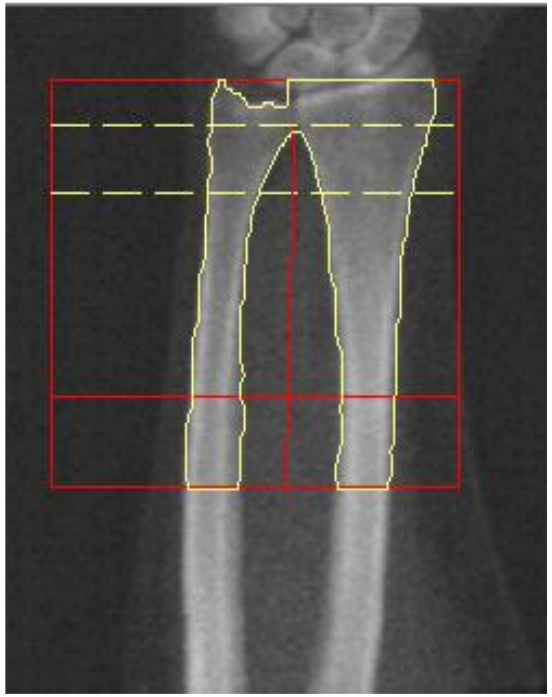
Make sure the GE Lunar positioner is correctly positioned. (Refer to the refence manual before you perform this scan!!!)

These can be done sitting in a chair or lying down.

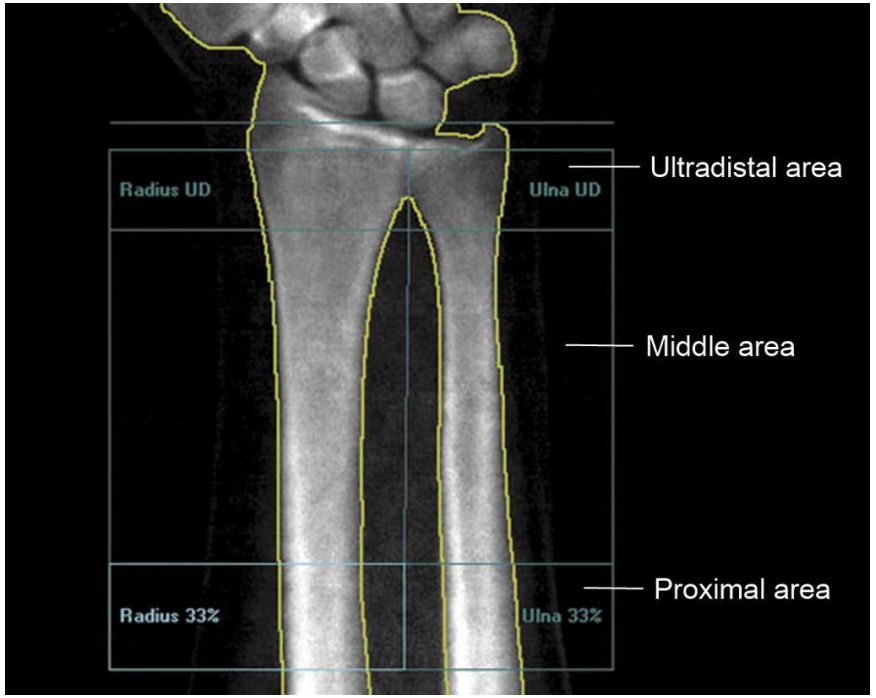
In any case make sure you do it the same every time. This includes using the same chair every time.

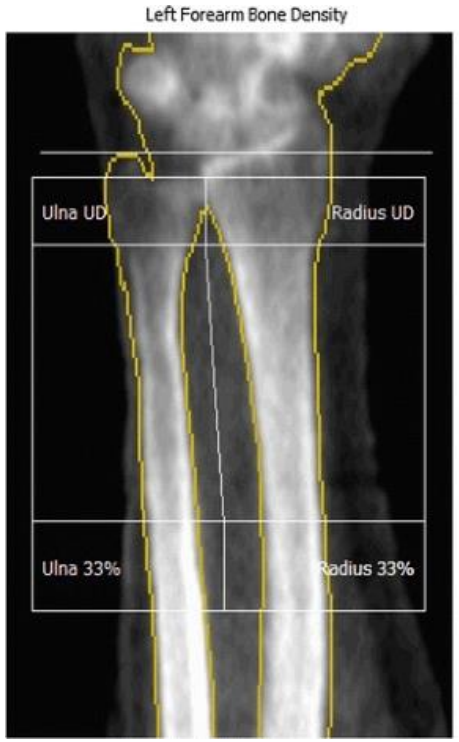
Forearm Image

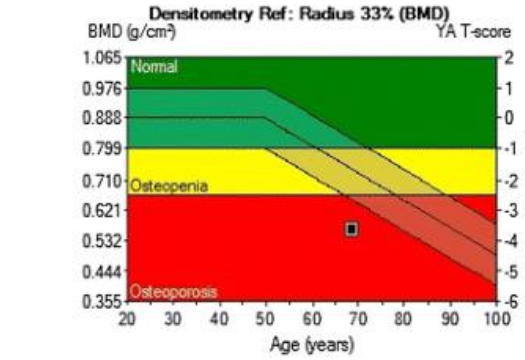
Hologic



GE Lunar







Region	BMD [1] (g/cm²)	Young-Adult [2] T-score	Age-Matched [3] Z-score
Radius 33%	0.560	-3.7	-2.0

Left Forearm Analysis

Image not for diagnostic use
k=1.187 d0=65.1 t=
TOTAL BMD CV is Less than 1.0%

C.F.	1.025	1.006	1.000		
Ulna	Area (cm²)	BMC (g)	BMD (g/cm²)	T-Score	Z-Score
UD	1.73	1.07	0.620	5.6	6.4
MID	3.66	2.36	0.646	1.6	2.7
1/3	2.08	1.40	0.673	-0.0	0.9
TOTAL	7.47	4.84	0.648	2.1	3.1

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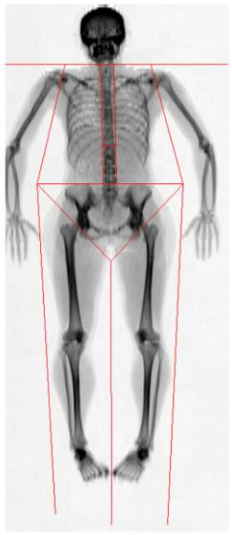
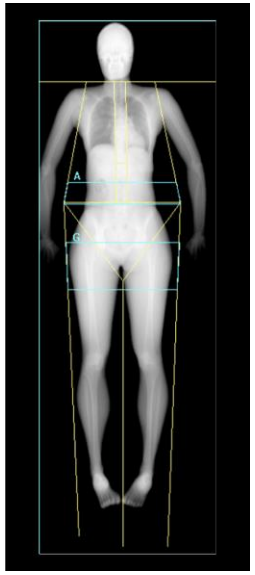
Version 12.0 :3 06/20/2003 11:47

Forearm Results




Total Body Composition Scan

Body Composition by DXA

John Shepherd, Bennett Ng, Markus Sommer, and Steven B. Heymsfield

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Body composition measurements from DXA have been available since DXA technology was developed 30years ago but are historically underutilized.

DXA is the preferred method for bone and body composition.

The two X-ray attenuations passing through the body can be used to accurately calculate the mass of two different materials given simple algebra and the physical properties of those materials

DXA can measure regional body composition by subdividing the body using specific well-defined cut lines.

Body Composition by DXA

DXA does expose the patient and operator to ionizing radiation, but the dose is very small to both.

Both Hologic and GE systems have the NHANES data integrated into their software to generate Z-scores for various adiposity and lean mass measures.

DXA uses Fat Mass Index (FMI) FMI has a distinct advantage over BMI for defining obesity status since it is independent of lean mass status.

sex-specific cut points for normal, excess fat, obesity I, obesity II, and obesity III. DXA system also report estimates for visceral adipose tissue (VAT) for either Hologic or GE systems.

Body Composition by DXA

Much of the advancement in the use of DXA for sports and fitness has been application of the technology that has been available for years. Yet, there is a unique place for DXA in evaluating the success of sports, diet, and fitness interventions because of its unique ability to simultaneously measure bone, lean, and fat mass status.

Total body Scan Prep

Restrictions

- No Barium X-ray or Nuclear medicine test within 2 weeks of the study
- No CT (Iodine) or MRI (Gadolinium) contrast within 1 week of the study
- DXA is an x-ray source so we can scan individuals with metal implants. However, large amounts of implants like Rods in the limbs and spine and large plates and screws can affect an accurate outcome.

Day of Scan

Come fasting for six hours

Come not having exercised for 6 hours

Come with having removed ALL body Piercings.

Subject will fill out all appropriate paper work if any.

Subject will be asked to void Bladder.

Subject will Change into scrubs. Subject will need to remove all clothing including socks, for women Bra’s will also need to be removed. Underwear can stay on.

Subject will get total body composition scan.

Subject can change back into civilian cloth

Females of reproductive age (14-65) will need a UA (Pregnancy Test) Before the Scan.

Scan parameters

Scan will take approximately 3 minutes.

Patient will be asked to lay on back, with no pillow, with legs and arms straight.

Toes will be pointed up and slightly rotated inward (Hologic). We will have strap to hold feet into position.

If patient moves the scan will have to be started over.

Patient will be asked to not talk during scan.

Scan Parameters

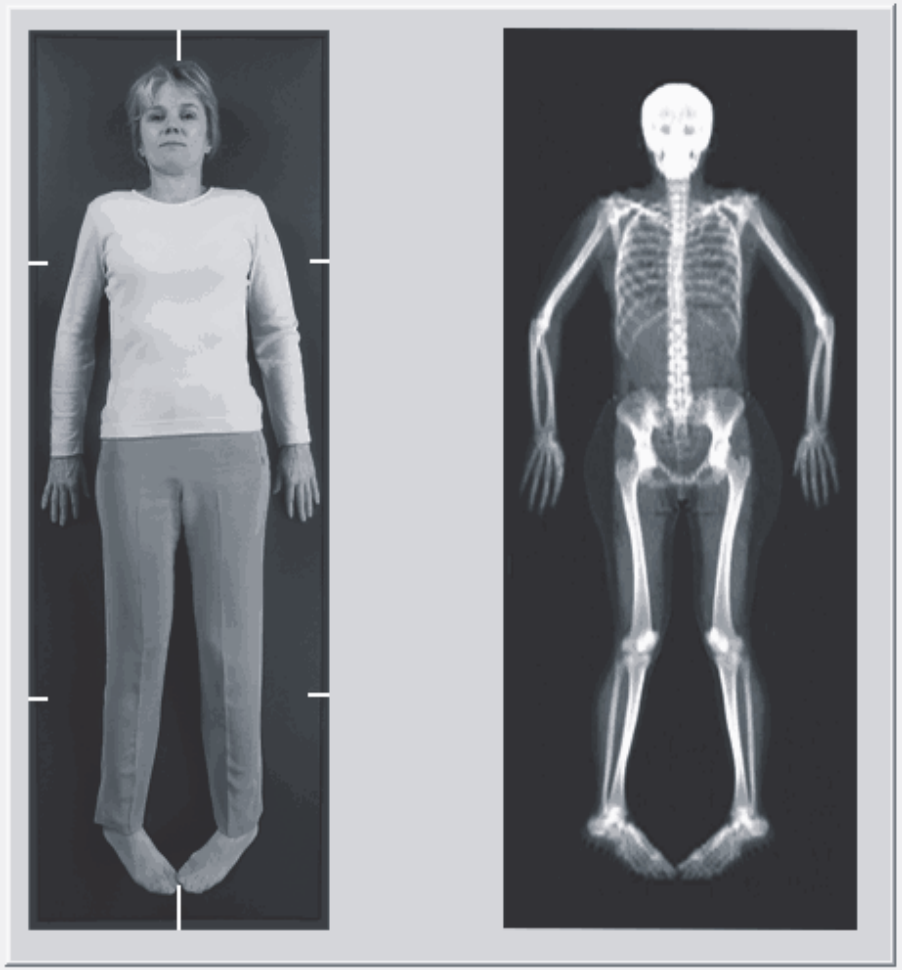
Patient Name:	Adria, Sophia A
Patient ID:	9000
Scan Type:	a Whole Body
Scan ID:	A10180207

Scan Length	77.0	in
Scan Width	26.4	in
Line Spacing	0.5130	in
Point Resolution	0.0804	in

4.00 X 0.08 Coll.
140/100 kVp
0.8 mA avg.
165 seconds
60 Hz

** XRAY DEVICE READY **

You may begin scanning

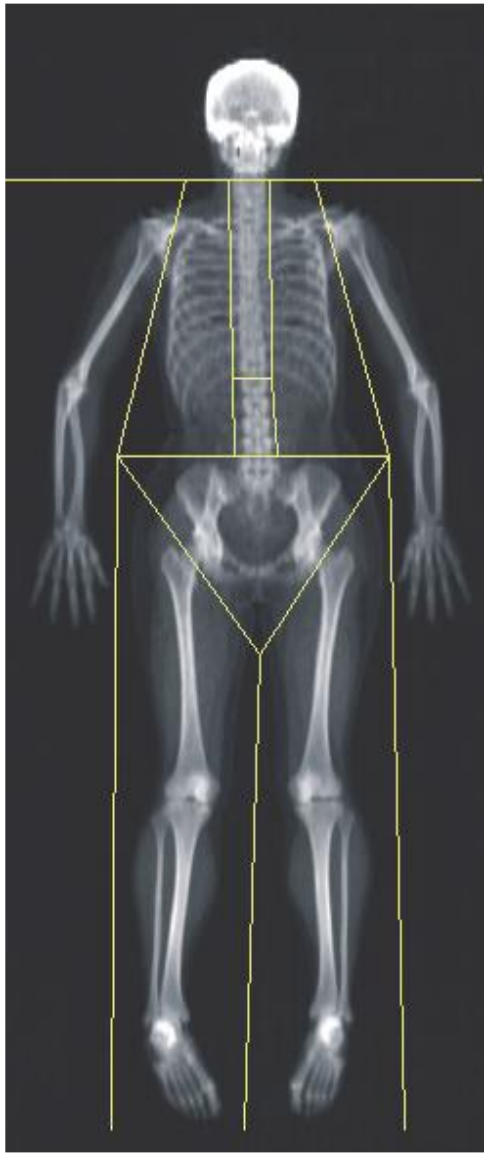


Please position the patient for a Whole Body scan

Start Scan

Cancel

The Regions are predefined as a template
overlay and can be adjusted to match the patient’s anatomy.



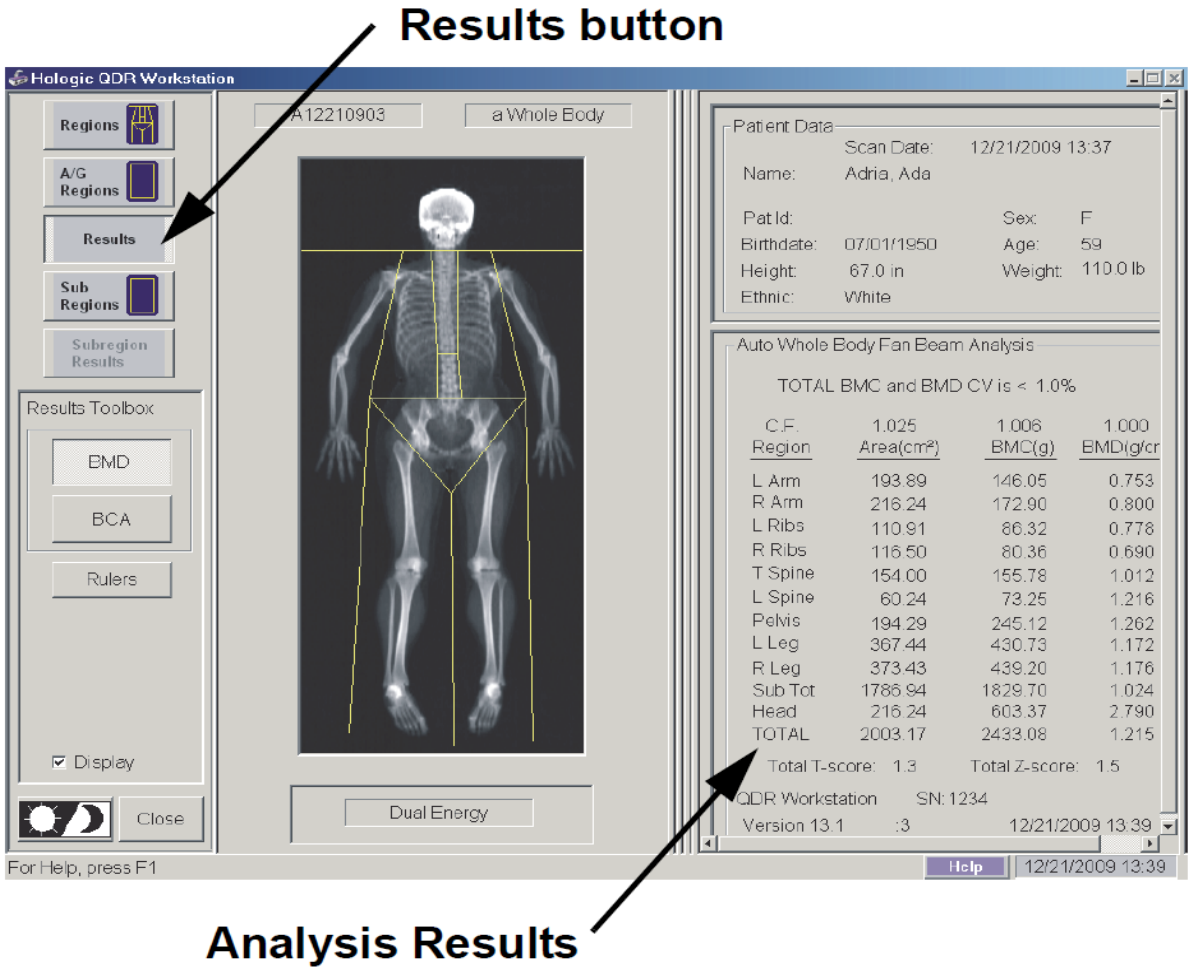
Total Body Scans Analysis Page

Whole Body Fan Beam Analysis

TBAR1058 - NHANES BCA
F.S. 68.00% -10.00%
Head assumes 17.0% brain fat
LBM 73.2% water

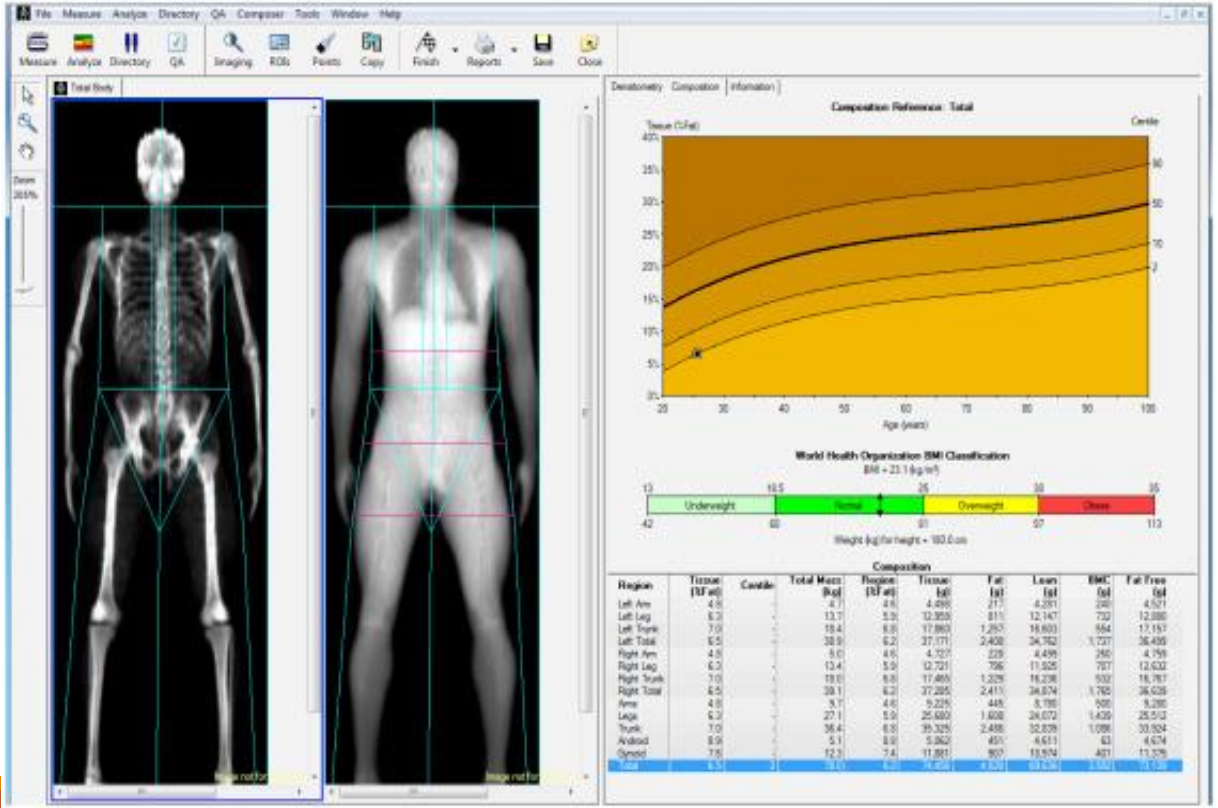
Region	Fat (g)	Lean+BMC (g)	Total (g)	%Fat
L Arm	948.5	1662.4	2610.9	36.3
R Arm	717.7	1481.2	2198.9	32.6
Trunk	6689.1	18605.6	25294.7	26.4
L Leg	2764.1	8552.4	11316.5	24.4
R Leg	2899.8	8169.8	11069.5	26.2
Sub Tot	14019.1	38471.4	52490.5	26.7
Head	879.6	2940.3	3819.9	23.0
TOTAL	**14898.7**	**41411.7**	**56310.4**	**26.5**
Android	1463.8	3181.3	4645.1	31.5
Gynoid	2075.3	6244.4	8319.7	24.9

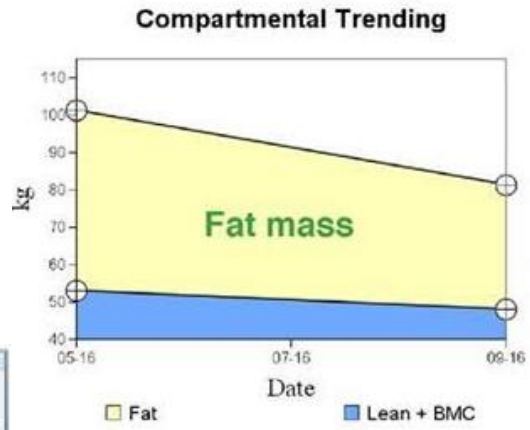
QDR Workstation SN: 123456
Version 13.0 :3 05/22/2008 15:26

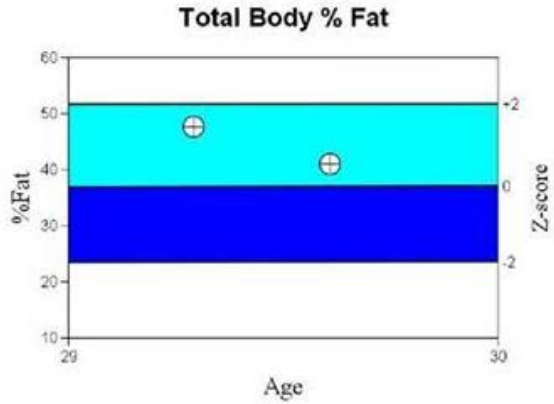


DXA Results Summary:

Region	BMC (g)	Fat Mass (g)	Lean Mass (g)	Lean+ BMC (g)	Total Mass Mass (g)	% Fat
L Arm	142.88	1723.6	1711.5	1854.4	3578.0	48.2
R Arm	162.16	1559.1	1764.3	1926.4	3485.6	44.7
Trunk	576.13	13157.8	24272.5	24848.7	38006.5	34.6
L Leg	407.72	4285.5	5929.1	6336.8	10622.3	40.3
R Leg	397.16	4239.0	5913.2	6310.4	10549.4	40.2
Subtotal	1686.05	24965.1	39590.6	41276.7	66241.8	37.7
Head	444.22	1033.2	2759.6	3203.9	4237.0	24.4
Total	**2130.27**	**25998.3**	**42350.3**	**44480.5**	**70478.8**	**36.9**







Total Body % Fat Results

Scan Date	Age	%Fat	Change Previous
24.09.2016	29	41.0	-6.6
31.05.2016	29	47.6	

Total Fat Mass Results

Scan Date	Age	Fat Mass (g)	Change Previous
24.09.2016	29	33358	-14852
31.05.2016	29	48210	

Total Lean Mass Results

Scan Date	Age	Lean (g)	Change Previous
24.09.2016	29	45363	-5088
31.05.2016	29	50451	

Total Mass Results

Scan Date	Age	Mass (g)	Change Previous
24.09.2016	29	81351	-19869
31.05.2016	29	101220	

Vertebral Fracture Assessment (VFA)

VFA is an image of the lumbar and thoracic spine acquired on DXA scanners, for the purpose of diagnosing Osteoporotic Vertebral Fractures.

VFA provides the ability to analyze the shape of vertebra using vertebral height measurements and calculations of those heights to compute wedge ratios

VFA is also called IVA by Hologic.

Reasoning for **Vertebral Fracture Assessment** (VFA)

Two thirds of fractures on X-ray are unappreciated and only 10% necessitated admission to the hospital.

Spinal X-rays may not be routinely performed in osteoporosis evaluation.

Many patients with vertebral fractures are osteopenic by DXA T-score. VFA would allow appropriate diagnosis of osteoporosis in these patients.

Many studies document association between prevalent vertebral fractures and the risk of future vertebral and non-vertebral fractures.

Other Names

Instant Vertebral Assessment

Lateral Vertebral Assessment

Morphometry of Vertebrae

Detection of Fractures

Separate read from DXA

Can eliminate additional spine films

Vertebral Fracture Assessment (VFA)

The thoracolumbar spine is imaged to

detect vertebral fractures using DXA.

Lateral images are obtained

at time of DXA testing.

Allows integration of BMD with

presence of vertebral fracture for diagnosis,

fracture risk assessment and patient management.

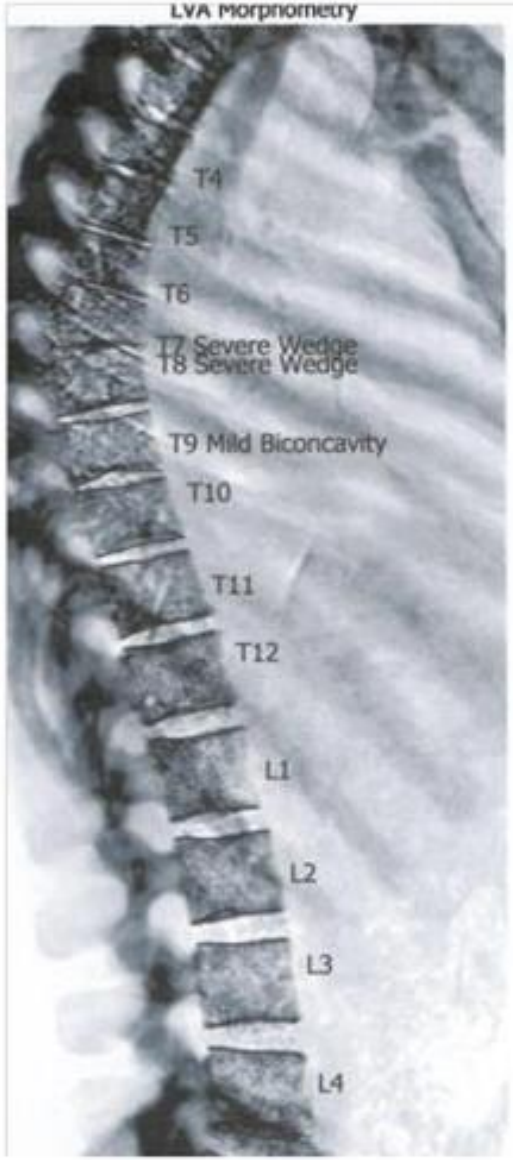
Lateral Positioning Hologic

C & W Models

SL & A Models
(Rotating Gantry)


Hologic QDR Workstation - [Analyze]
DE Scan
Multi View
Visual Tools
Analysis Tools
L 1945
W 1146
Reset
Invert
Flip
Print Report
Print Image
Close
A07171305
a SE AP Image
Patient Data
Deformity Tools
Patient Data
Name: IVA
Patient ID:
Sex: Female
Birth Date: 01/01/1950
Physician:
Height: 65.0 in
Weight: 150.0 lb
Age: 63
Ethnicity: White
Scan Date: 07/17/2013
Vertebral Assessment
Height(mm)
Percent Deformation
Label Post Mid Ant Wedge Biconcave Crush
Deformity (Grade)
Std Dev 1.0 1.0 1.0 5.0% 5.0% 5.0%
* denotes automatic assessment update
For Help, press F1
Help
07/17/2013 17:32


Scan Parameters
Patient Name: Adria, Sophia A
Patient ID: 9000
Scan Type: f SE AP Image
Scan ID: A01030305
Scan Length 16.1 in
Scan Width 4.5 in
Line Spacing 0.0142 in
Point Resolution 0.0355 in
2.40 X 0.02 Coll.
140/140 kVp
5.0 mA avg.
10 seconds
60 Hz
** XRAY DEVICE READY **
You may begin scanning
Please position the patient for a SE AP Image scan
Start Scan
Cancel

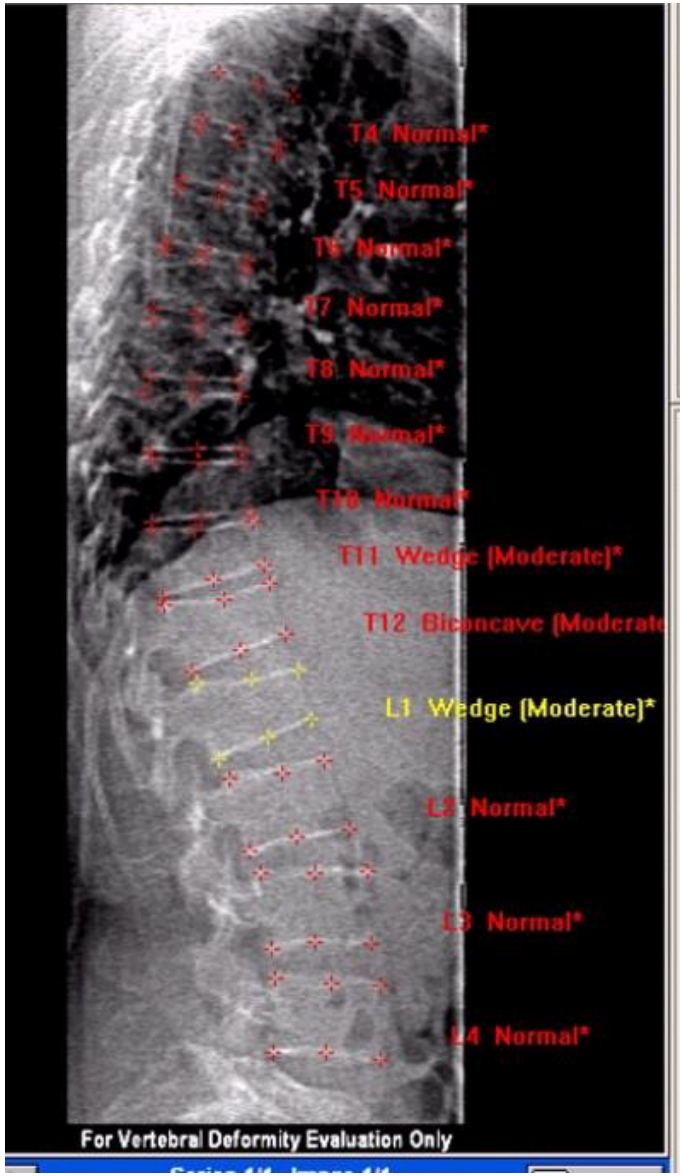


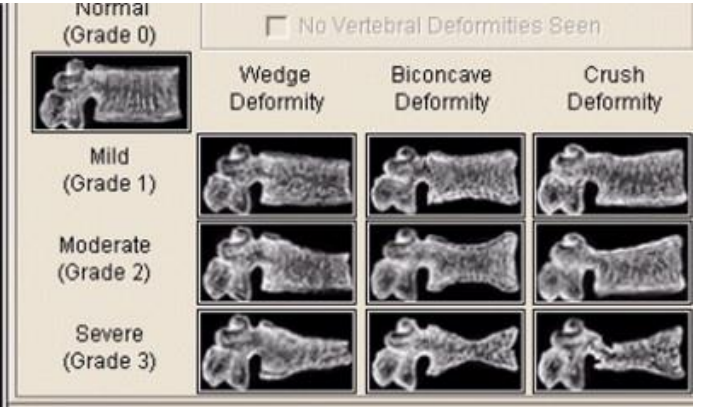
Region [1]	Avg. Ht. [2] (cm)	Z-score	M/P Ratio [2] (%)	Z-score	A/P Ratio [2] (%)	Z-score
T4	1.70	-1.6	100	1.1	101	0.9
T5	1.97	-0.2	89	-0.5	94	-0.1
T6	1.71	-1.9	99	1.0	95	0.5
T7	1.82	-1.5	80	-1.9	62	-4.5
T8	1.93	-1.1	88	-0.6	59	-4.9
T9	2.04	-0.9	78	-2.3	93	0.0
T10	2.20	-0.8	87	-1.1	92	-0.3
T11	2.37	-0.4	88	-0.7	91	-0.2
T12	2.60	0.0	92	-0.2	97	0.7
L1	2.77	0.1	88	-0.8	99	1.1
L2	2.83	0.0	90	-0.5	93	-0.3
L3	2.80	-0.4	91	-0.5	99	0.2
L4	2.97	0.4	102	0.8	108	1.2

Severe Wedge
Mild Biconcavity

COMMENTS:

GE Lunar Report

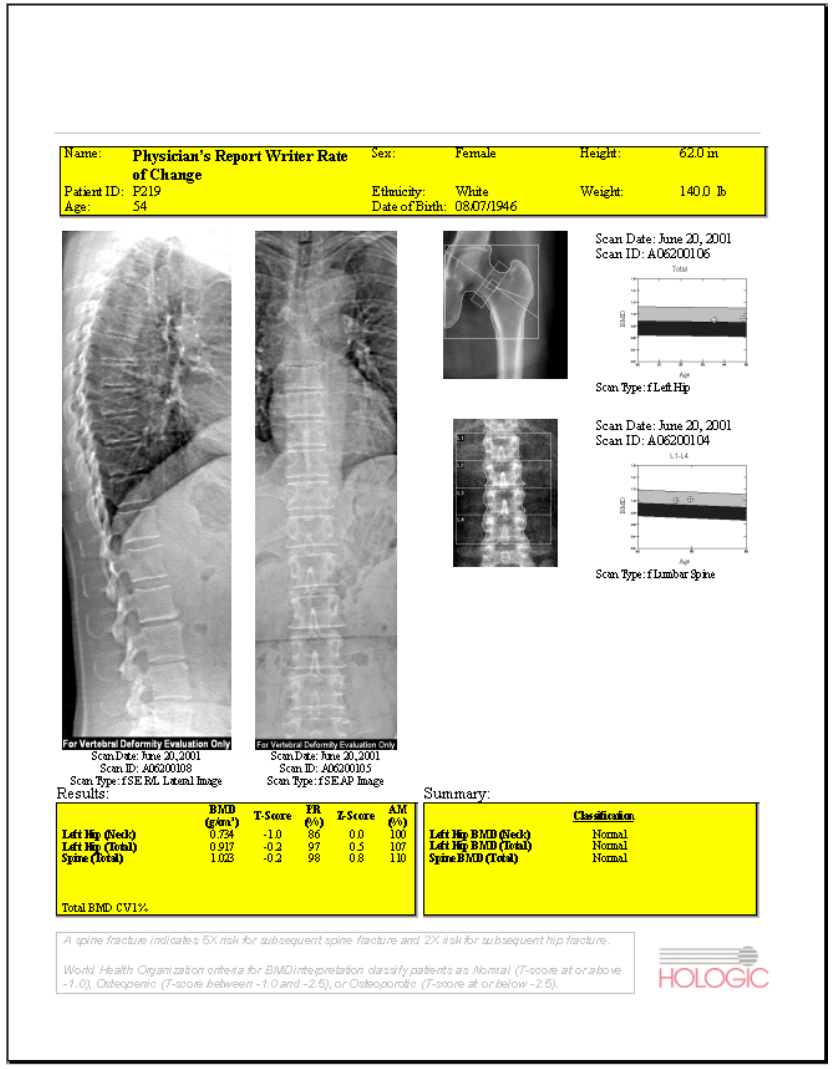




Vertebral Assessment

Label	Height (mm) Post	Mid	Ant	Percent Deformation Wedge	Biconcave	Crush
	Deformity (Grade)					
T4	17.8	18.3	18.2	0.0%	-3.1%	2.5%
	Normal					
T5	19.9	17.9	18.5	6.8%	9.9%	0.0%
	Normal					
T6	19.4	18.1	19.2	1.1%	6.7%	0.0%
	Normal					
T7	21.1	19.6	18.5	12.3%	6.8%	0.0%
	Normal					
T8	20.9	19.4	18.7	10.5%	7.0%	0.0%
	Normal					
T9	21.1	20.2	19.5	7.3%	4.3%	0.0%
	Normal					
T10	22.4	20.2	18.3	18.5%	9.9%	0.0%
	Normal					
T11	24.3	18.8	16.1	33.7%	22.5%	0.0%
	Wedge (Moderate)					
T12	26.3	19.4	19.4	26.2%	26.5%	0.0%
	Biconcave (Moderate)					
L1	28.9	22.5	18.1	37.6%	22.4%	0.0%
	Wedge (Moderate)					
L2	27.0	23.7	27.1	0.0%	12.2%	0.5%
	Normal					
L3	27.8	25.4	26.4	5.2%	8.8%	0.0%
	Normal					
L4	27.3	25.1	26.7	2.2%	8.3%	0.0%
	Normal					
Std Dev	1.0	1.0	1.0	5.0%	5.0%	5.0%

Hologic Report



Name:	Physician's Report Writer Rate of Change	Sex:	Female	Height:	62.0 in
Patient ID:	P219	Ethnicity:	White	Weight:	140.0 lb
Age:	54	Date of Birth:	08/07/1946		

Results:

	BMD (g/cm²)	T-Score	FR (%)	Z-Score	AM (%)
Left Hip (Neck)	0.734	-1.0	86	0.0	100
Left Hip (Total)	0.917	-0.2	97	0.5	107
Spine (Total)	1.023	-0.2	98	0.8	110

Total BMD CV1%

Summary:

Classification	
Left Hip BMD (Neck)	Normal
Left Hip BMD (Total)	Normal
Spine BMD (Total)	Normal

A spine fracture indicates 5X risk for subsequent spine fracture and 2X risk for subsequent hip fracture.

World Health Organization criteria for BMD interpretation classify patients as Normal (T-score at or above -1.0), Osteopenic (T-score between -1.0 and -2.5), or Osteoporotic (T-score at or below -2.5).

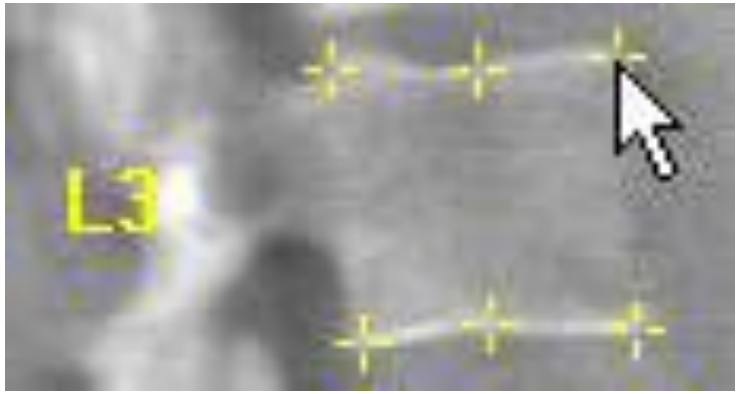
HOLOGIC

New Formats

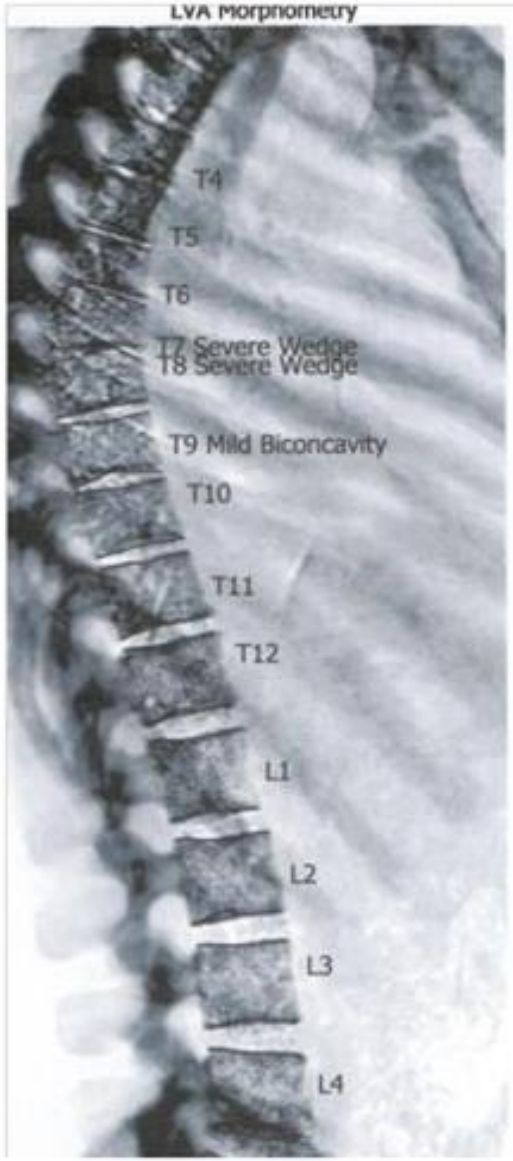

Lateral AP


AP IVA


Hologic QDR Workstation - [Analyze]
DE Scan
Multi View
Visual Tools
Analysis Tools
L 1944
W 1156
Revert
Invert
Flip
Print Report
Print Image
Close
A07171306
a SE Lateral Image
Patient Data
Deformity Tools
Patient Data
Name: N/A
Patient ID:
Sex: Female
Birth Date: 01/01/1950
Physician:
Height: 65.0 in
Weight: 150.0 lb
Age: 63
Ethnicity: White
Scan Date: 07/17/2013
Vertebral Assessment
Height(mm)
Percent Deformation
Label Post Mid Ant
Wedge Biconcave Crush
Deformity (Grade)
Std Dev 1.0 1.0 1.0 5.0% 5.0% 5.0%
* denotes automatic assessment update
For Help, press F1
Help
07/17/2013 17:48


L3


L3 Wedge (Mild)

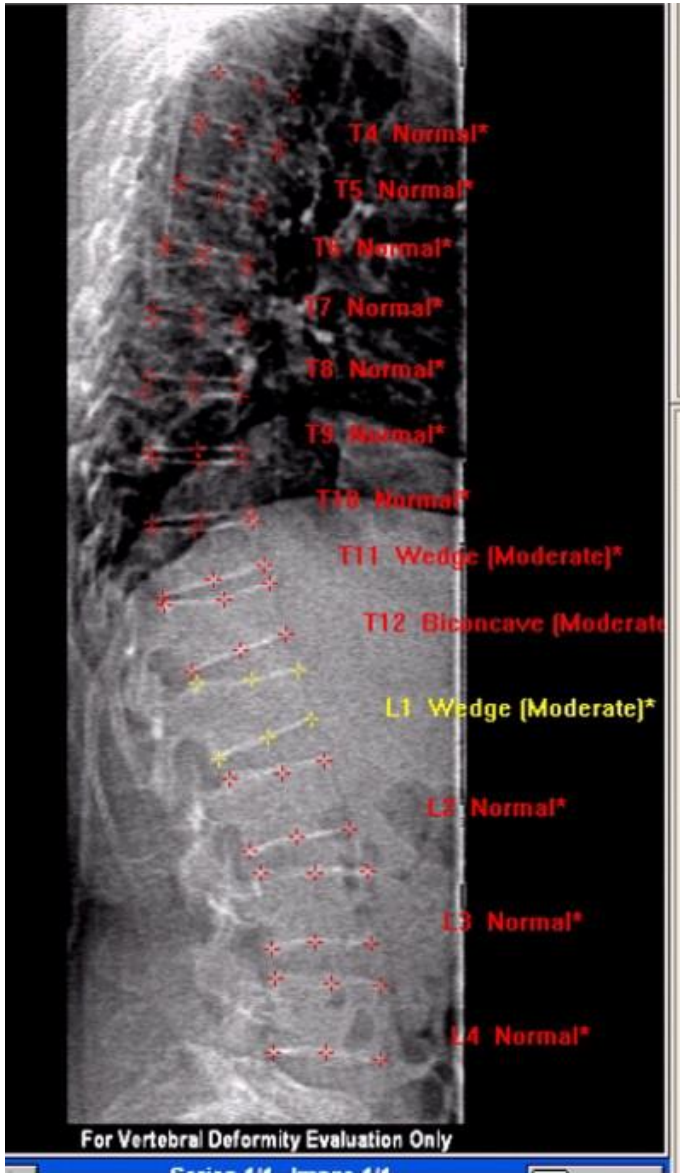


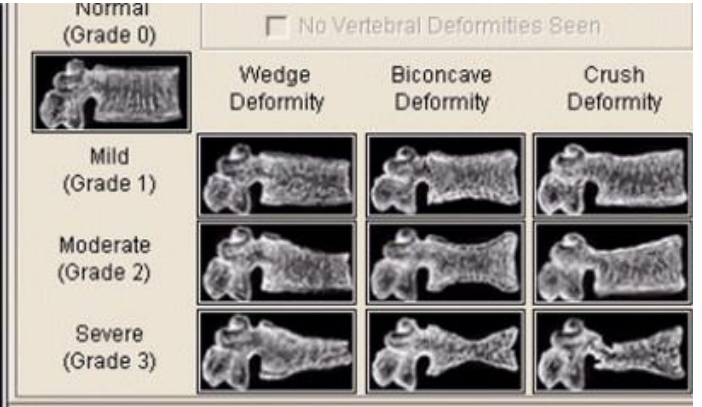
Region [1]	Avg. Ht. [2] (cm)	Z-score	M/P Ratio [2] (%)	Z-score	A/P Ratio [2] (%)	Z-score
T4	1.70	-1.6	100	1.1	101	0.9
T5	1.97	-0.2	89	-0.5	94	-0.1
T6	1.71	-1.9	99	1.0	95	0.5
T7	1.82	-1.5	80	-1.9	62	-4.5
T8	1.93	-1.1	88	-0.6	59	-4.9
T9	2.04	-0.9	78	-2.3	93	0.0
T10	2.20	-0.8	87	-1.1	92	-0.3
T11	2.37	-0.4	88	-0.7	91	-0.2
T12	2.60	0.0	92	-0.2	97	0.7
L1	2.77	0.1	88	-0.8	99	1.1
L2	2.83	0.0	90	-0.5	93	-0.3
L3	2.80	-0.4	91	-0.5	99	0.2
L4	2.97	0.4	102	0.8	108	1.2

Severe Wedge
Mild Biconcavity

GE Lunar Report

COMMENTS:





Vertebral Assessment

Label	Height (mm) Post	Mid	Ant	Percent Deformation Wedge	Biconcave	Crush
	Deformity (Grade)					
T4	17.8	18.3	18.2	0.0%	-3.1%	2.5%
	Normal					
T5	19.9	17.9	18.5	6.8%	9.9%	0.0%
	Normal					
T6	19.4	18.1	19.2	1.1%	6.7%	0.0%
	Normal					
T7	21.1	19.6	18.5	12.3%	6.8%	0.0%
	Normal					
T8	20.9	19.4	18.7	10.5%	7.0%	0.0%
	Normal					
T9	21.1	20.2	19.5	7.3%	4.3%	0.0%
	Normal					
T10	22.4	20.2	18.3	18.5%	9.9%	0.0%
	Normal					
T11	24.3	18.8	16.1	33.7%	22.5%	0.0%
	Wedge (Moderate)					
T12	26.3	19.4	19.4	26.2%	26.5%	0.0%
	Biconcave (Moderate)					
L1	28.9	22.5	18.1	37.6%	22.4%	0.0%
	Wedge (Moderate)					
L2	27.0	23.7	27.1	0.0%	12.2%	0.5%
	Normal					
L3	27.8	25.4	26.4	5.2%	8.8%	0.0%
	Normal					
L4	27.3	25.1	26.7	2.2%	8.3%	0.0%
	Normal					
Std Dev	1.0	1.0	1.0	5.0%	5.0%	5.0%

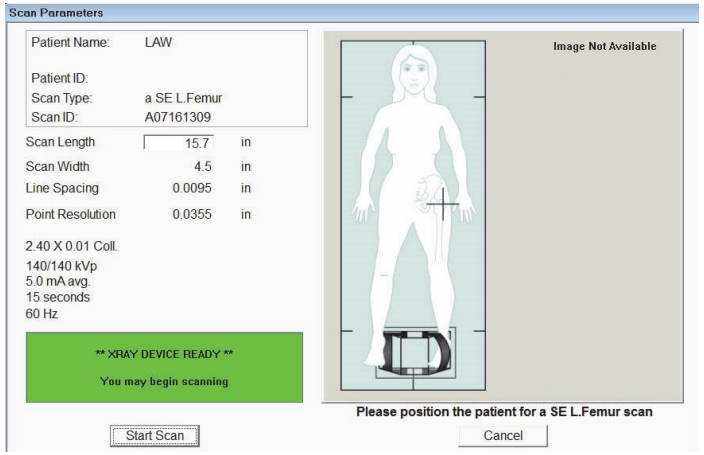
Hologic Report

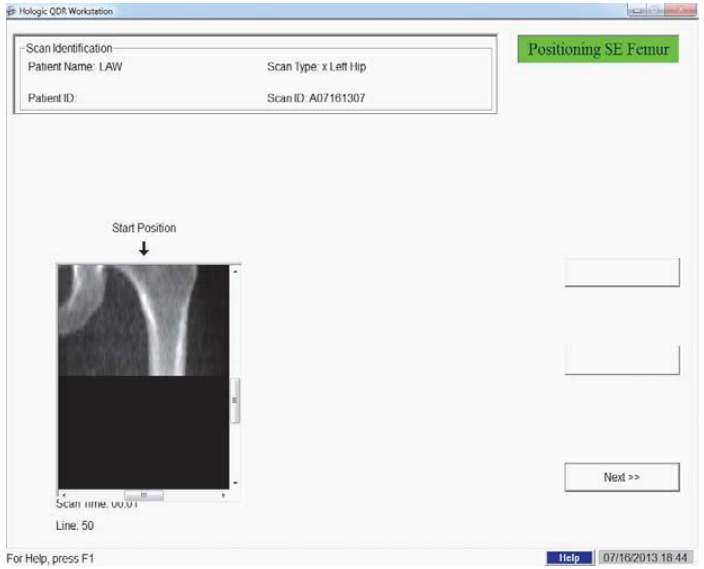
Orthopedic Analysis™

Orthopedic Analysis™

Hip prostheses, metal fastenings, and other artifacts are easily excluded from the analysis region for accurate bone density results.

http://www.gemedicalsystemseurope.com





Atypical Femur Fracture Scan

SE Femur

This scan is performed when a patient has been on an Osteoporosis therapy for a very long period and the patient is having femur pain.

This is done to detect Atypical Femur Fracture a side effect of bisphosphonates.

The atypical femur fracture is detected by a beaking sign.

If not taken care of a traumatic fracture may occur.

Beaking

OH NO !!!

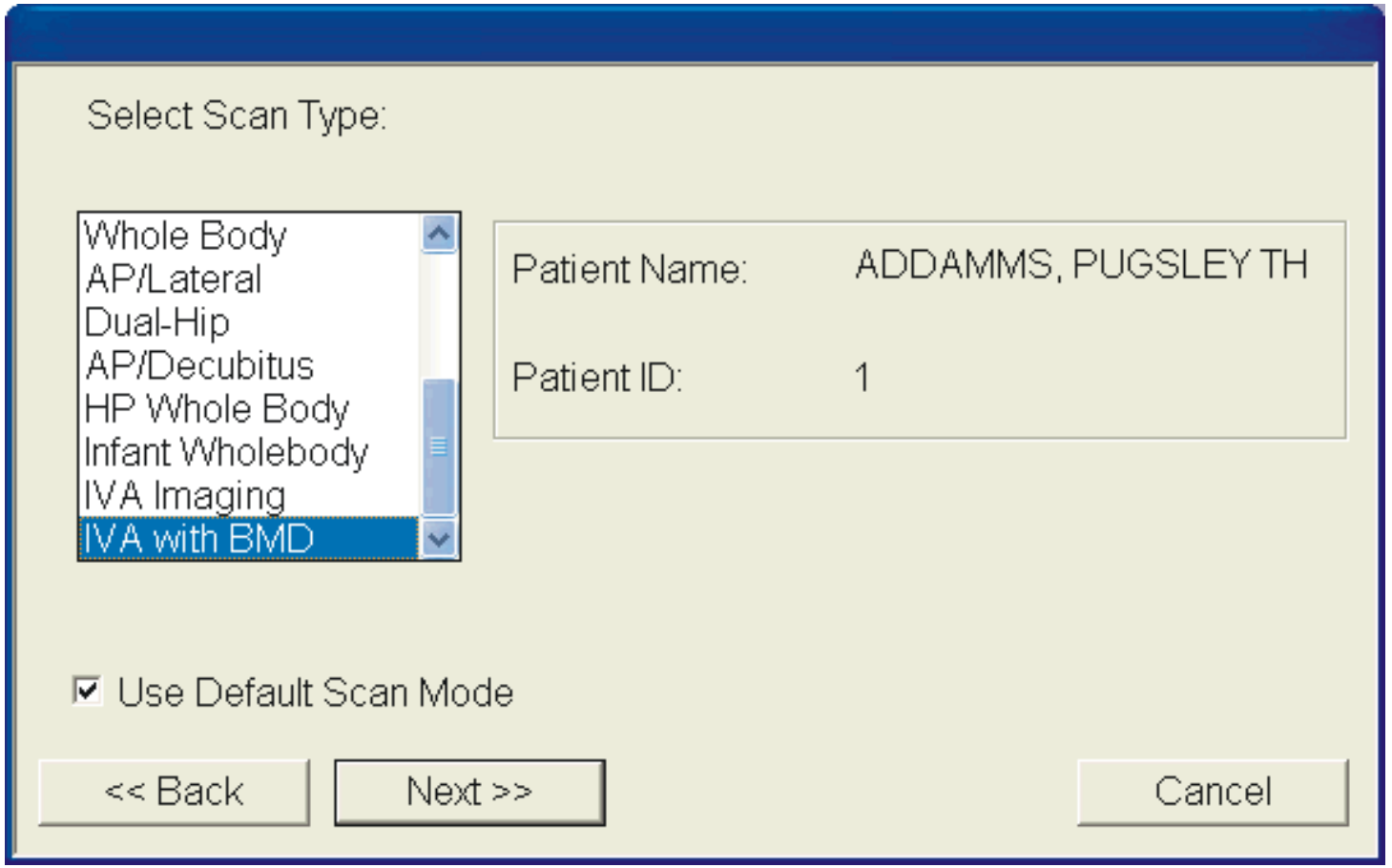
Not taken care of

SE Femur Image Viewer

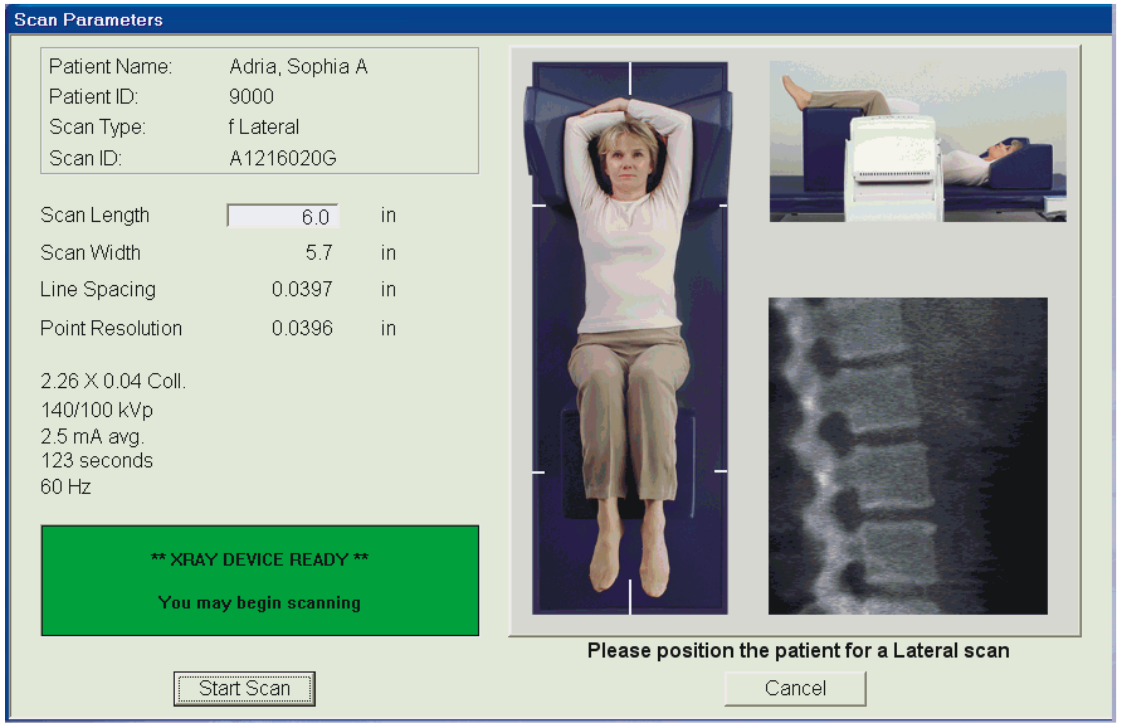
The image appears in the SE Femur Image Viewer.
The Viewer allows the operator to view the SE Femur image.
There are controls on the Viewer to change viewing modes, zoom, adjust the brightness and contrast of the image, place Rulers and print a report or image.

Visual Assessment

Visually inspect the image for deformity1 2 3 particularly along the lateral cortex from the lesser trochanter to the supracondyal flare. Look for focal reaction or thickening along the lateralcortex, which may be accompanied by a transverse radiolucent line. Use the visual tools to increase magnification and adjust the contrast as the changes in the lateral cortex may be
subtle.


Select Scan Type:
Whole Body
AP/Lateral
Dual-Hip
AP/Decubitus
HP Whole Body
Infant Wholebody
IVA Imaging
IVA with BMD
Patient Name: ADDAMMS, PUGSLEY TH
Patient ID: 1
Use Default Scan Mode
<< Back
Next >>
Cancel

IVA with BMD


Scan Parameters
Patient Name: Adria, Sophia A
Patient ID: 9000
Scan Type: f Lateral
Scan ID: A1216020G
Scan Length 6.0 in
Scan Width 5.7 in
Line Spacing 0.0397 in
Point Resolution 0.0396 in
2.26 X 0.04 Coll.
140/100 kVp
2.5 mA avg.
123 seconds
60 Hz
** XRAY DEVICE READY **
You may begin scanning
Start Scan
Please position the patient for a Lateral scan
Cancel


Scan Parameters
Patient Name: Adria, Sophia A
Patient ID: 9000
Scan Type: f Lumbar Spine
Scan ID: A1216020F
Scan Length 8.0 in
Scan Width 4.5 in
Line Spacing 0.0397 in
Point Resolution 0.0355 in
2.51 X 0.04 Coll.
140/100 kVp
2.5 mA avg.
41 seconds
60 Hz
** XRAY DEVICE READY **
You may begin scanning
Start Scan
Please position the patient for a Lumbar Spine scan
Cancel

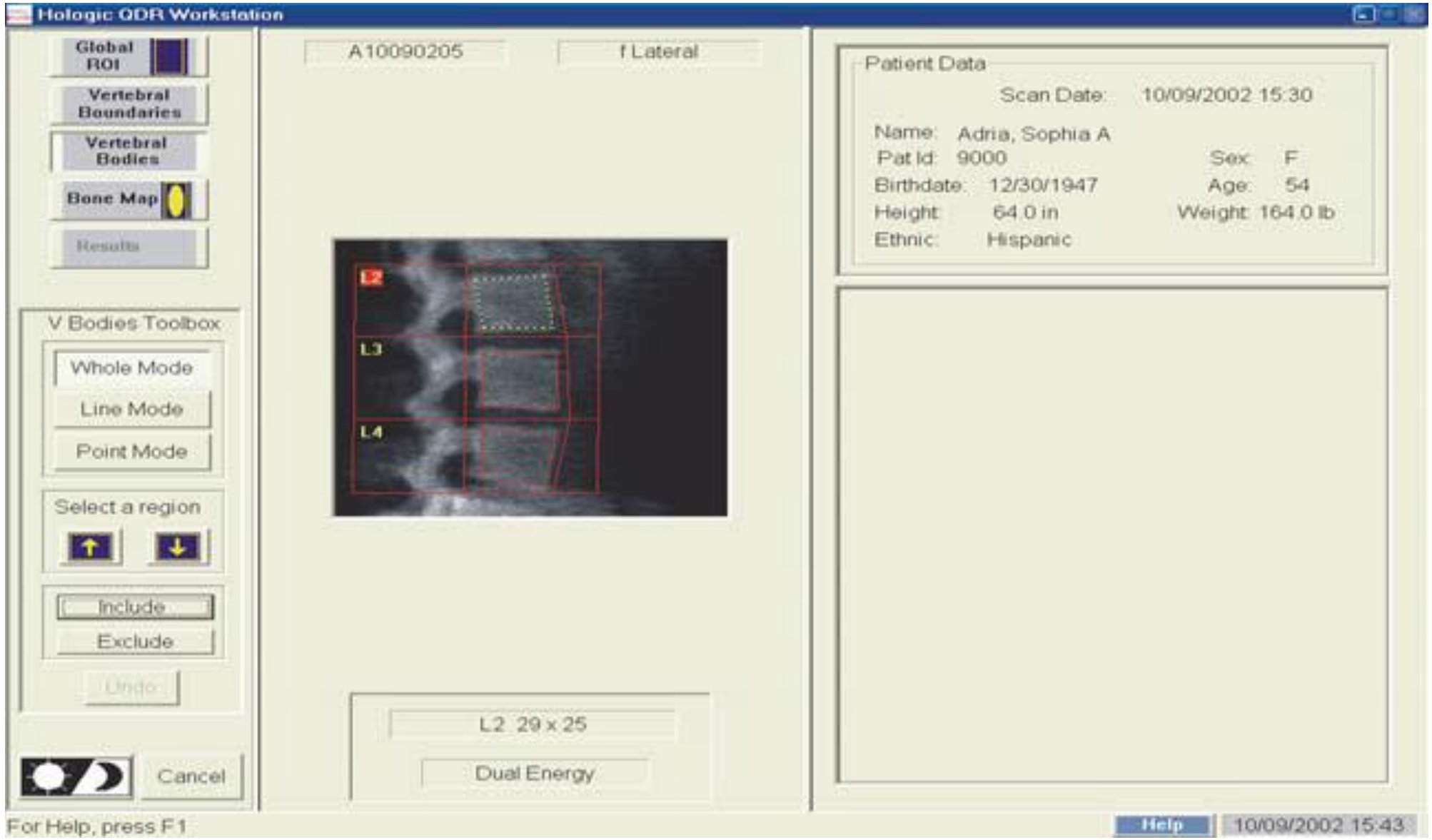
The Lateral IVA Scan

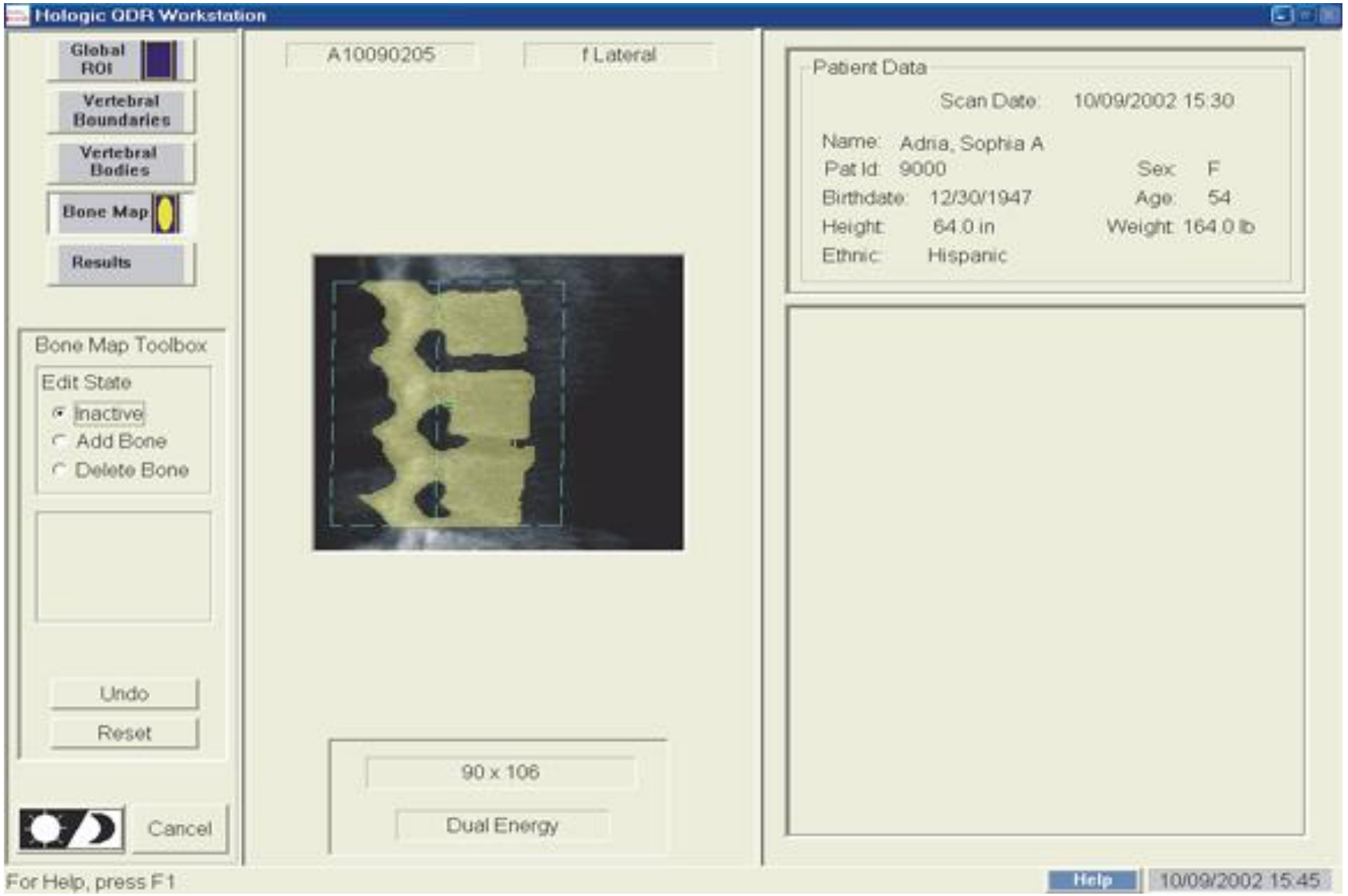
The activities involved in performing the Lateral IVA Scan include:

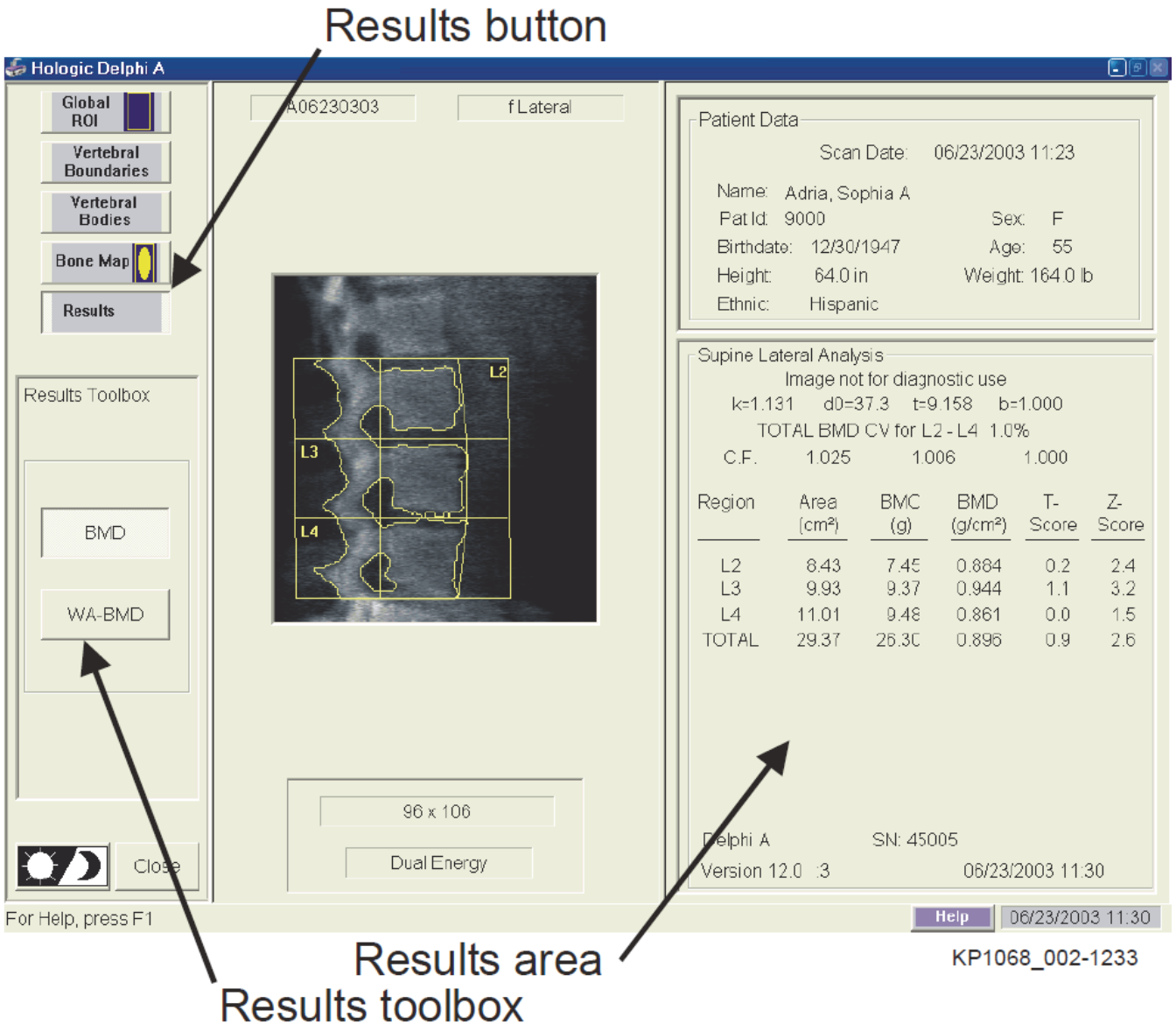
- Confirming Scan parameters for Lateral IVA Scan
- Performing the Lateral IVA Scan
- Using the IVA Image Viewer for the Lateral IVA Scan

Confirming Scan Parameters for Lateral IVA Scan

After the Lateral BMD scan is complete, the scan parameter screen for the Lateral IVA (f SE Lateral Image) will appear. The only scan parameter for the Lateral IVA that can be modified
is the scan length. The scan length is 16.1 inches (40.8 cm).


Hologic QDR Workstation
Global ROI
Vertebral Boundaries
Vertebral Bodies
Bone Map
Results
V Bodies Toolbox
Whole Mode
Line Mode
Point Mode
Select a region
Include
Exclude
Undo
Cancel
A10090205
f Lateral
L2
L3
L4
L2 29 x 25
Dual Energy
Patient Data
Scan Date: 10/09/2002 15:30
Name: Adria, Sophia A
Pat Id: 9000
Sex: F
Birthdate: 12/30/1947
Age: 54
Height: 64.0 in
Weight: 164.0 lb
Ethnic: Hispanic
For Help, press F1
Help
10/09/2002 15:43


Hologic QDR Workstation
Global ROI
Vertebral Boundaries
Vertebral Bodies
Bone Map
Results
Bone Map Toolbox
Edit State
Inactive
Add Bone
Delete Bone
Undo
Reset
Cancel
A10090205
f Lateral
90 x 106
Dual Energy
Patient Data
Scan Date: 10/09/2002 15:30
Name: Adria, Sophia A
Pat Id: 9000
Sex: F
Birthdate: 12/30/1947
Age: 54
Height: 64.0 in
Weight: 164.0 lb
Ethnic: Hispanic
For Help, press F1
Help
10/09/2002 15:45


Results button
Hologic Delphi A
Global ROI
Vertebral Boundaries
Vertebral Bodies
Bone Map
Results
Results Toolbox
BMD
WA-BMD
Close
A06230303
f Lateral
L2
L3
L4
96 x 106
Dual Energy
Patient Data
Scan Date: 06/23/2003 11:23
Name: Adria, Sophia A
Pat Id: 9000
Sex: F
Birthdate: 12/30/1947
Age: 55
Height: 64.0 in
Weight: 164.0 lb
Ethnic: Hispanic
Supine Lateral Analysis
Image not for diagnostic use
k=1.131 d0=37.3 t=9.158 b=1.000
TOTAL BMD CV for L2 - L4 1.0%
C.F. 1.025 1.006 1.000
Region | Area (cm²) | BMC (g) | BMD (g/cm²) | T-Score | Z-Score
L2 8.43 7.45 0.884 0.2 2.4
L3 9.93 9.37 0.944 1.1 3.2
L4 11.01 9.48 0.861 0.0 1.5
TOTAL 29.37 26.30 0.896 0.9 2.6
Delphi A SN: 45005
Version 12.0 :3 06/23/2003 11:30
For Help, press F1
Help
06/23/2003 11:30
Results area
Results toolbox
KP1068_002-1233

Orthopedic Analysis™

Orthopedic Analysis™

Hip prostheses, metal fastenings, and other artifacts are easily excluded from the analysis region for accurate bone density results.

http://www.gemedicalsystemseurope.com

Trabecular Bone Score (TBS)

TBS iNsight is a software provided for use as a complement to a DXA analysis. It computes the antero-posterior spine DXA examination file and calculates a score (Trabecular Bone Score - TBS) that is compared to those of the age-matched controls.

TBS is a gray-level textural metric that can be extracted from the two-dimensional lumbar spine dual-energy X-ray absorptiometry (DXA) image.

TBS is related to bone microarchitecture and provides skeletal information that is not captured from the standard bone mineral density (BMD) measurement.

TBS Findings

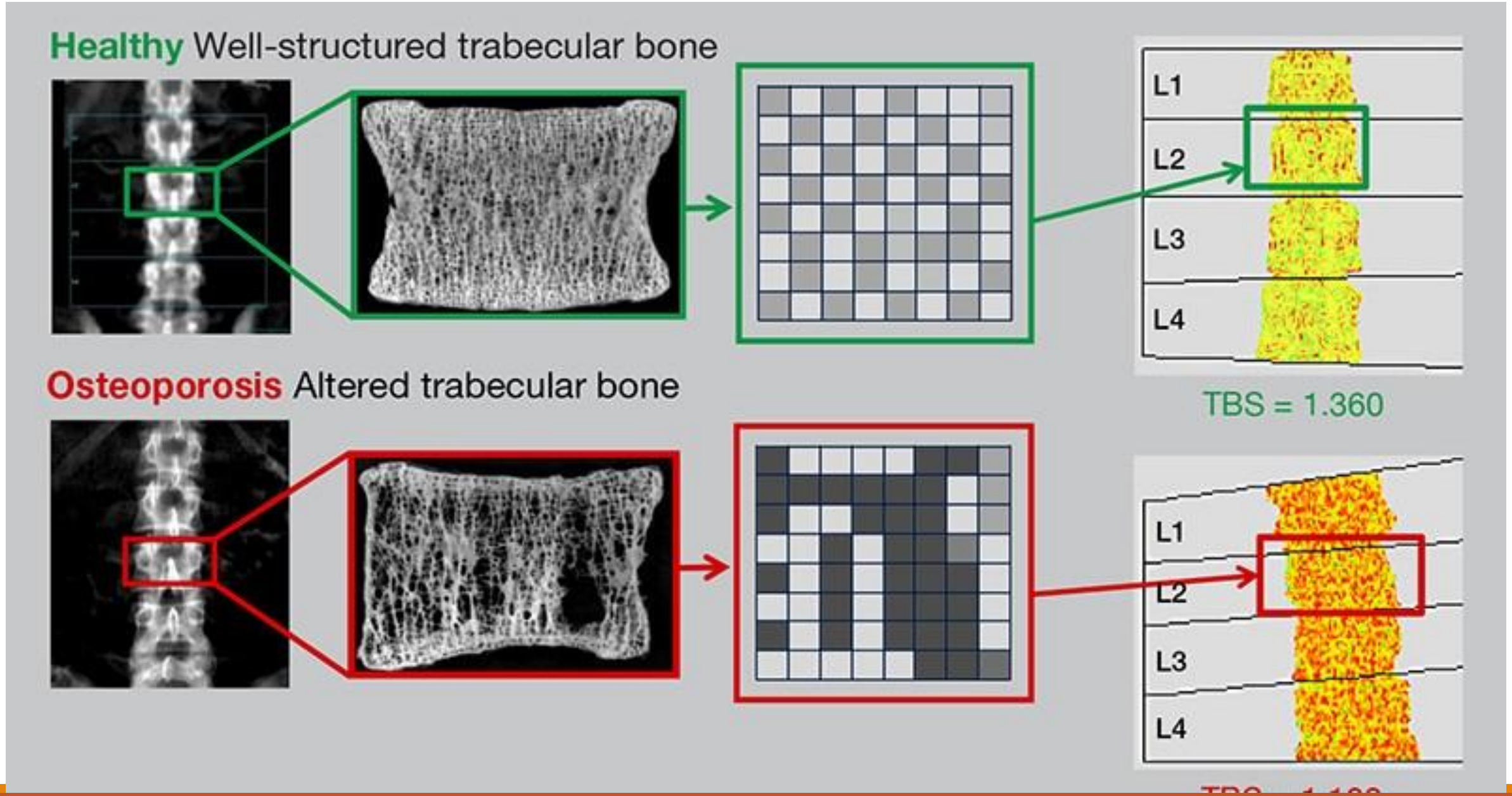
TBS gives lower values in postmenopausal women and in men with previous fragility fractures than their nonfractured counterparts.

TBS is complementary to data available by lumbar spine DXA measurements.

TBS results are lower in women who have sustained a fragility fracture but in whom DXA does not indicate osteoporosis or even osteopenia.

TBS predicts fracture risk as well as lumbar spine BMD measurements in postmenopausal women.

TBS is associated with fracture risk in individuals with conditions related to reduced bone mass or bone quality.


Healthy Well-structured trabecular bone
L1
L2
L3
L4
TBS = 1.360
Osteoporosis Altered trabecular bone
L1
L2
L3
L4

Risk Class based on Spine TBS	Risk Class based on minimum hip or spine BMD T-score		
	Normal	Osteopenia	Osteoporosis
≥ 1.300			
1.200 < > 1.300			
≤ 1.200			

Adapted from Table 3 in Hans et al. J Bone Miner Res. 2011 Nov;26(11):2762-9

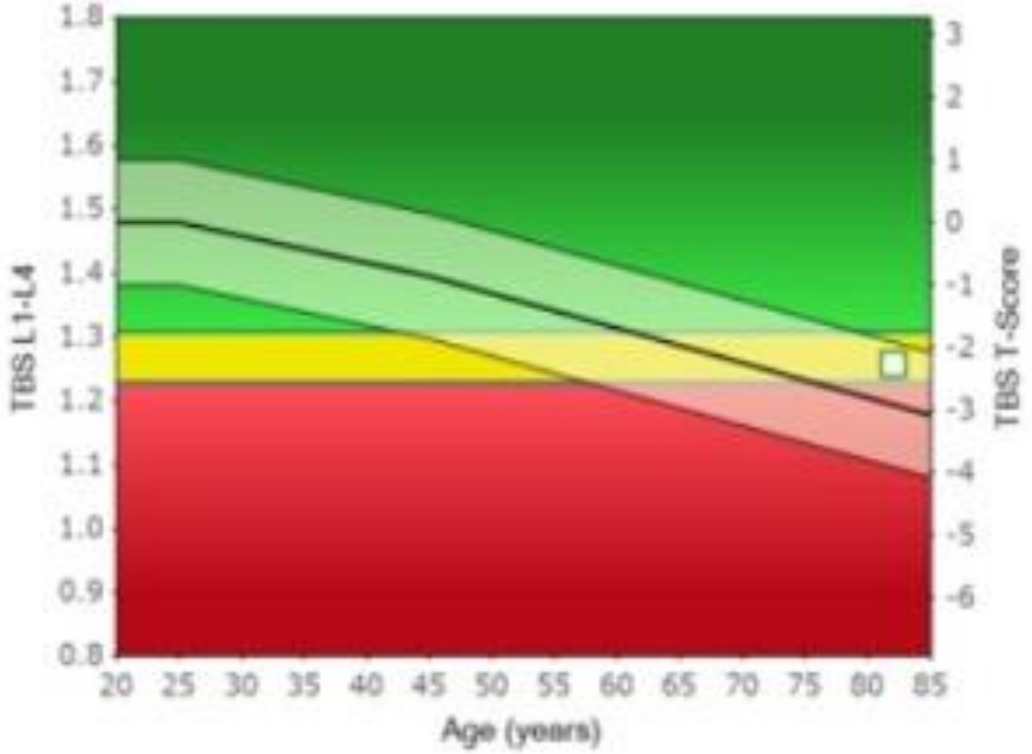
Color coded risk levels for major osteoporotic fracture per 1'000 women per year, based on a ≈30'000 women study.

SPINE TBS REPORT

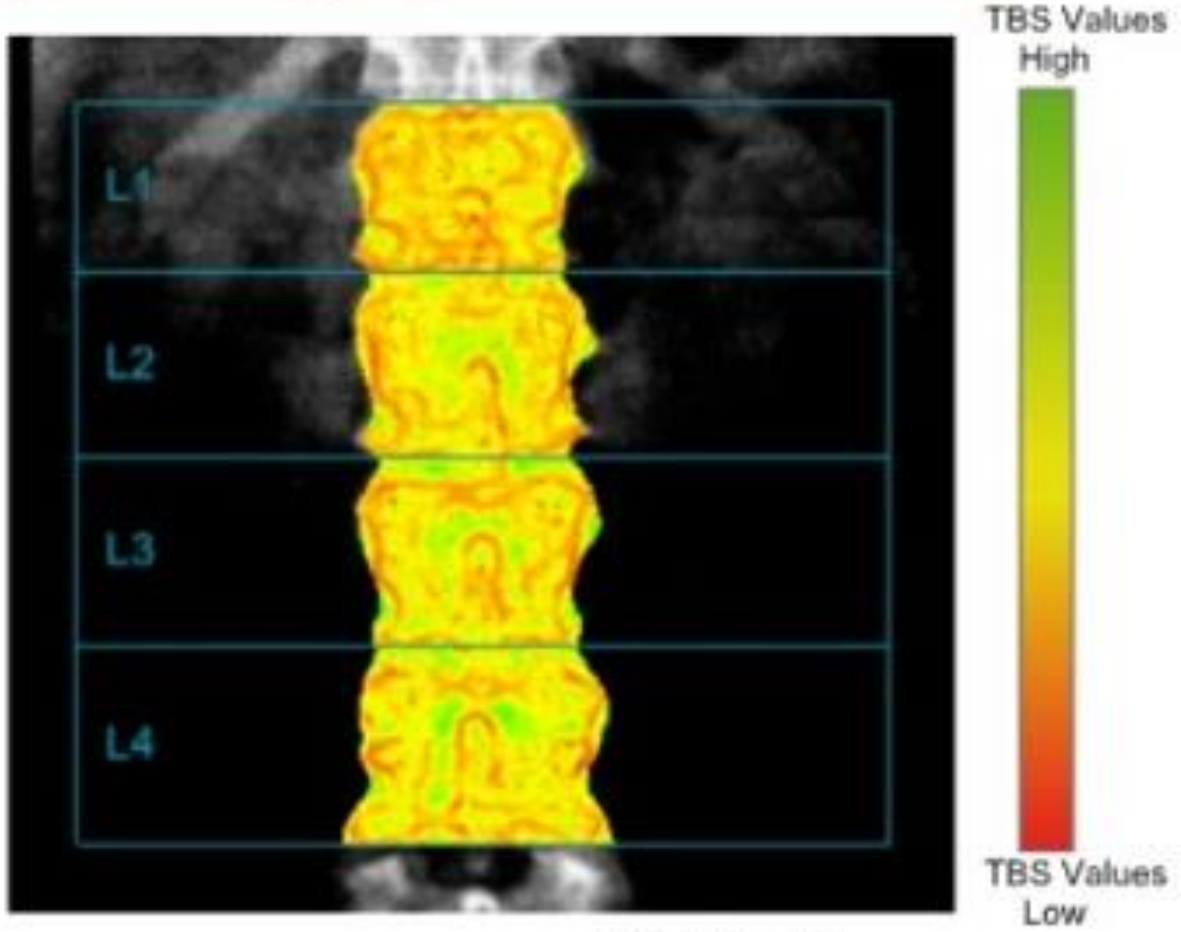
TBS reference graph

Reference population: USA (NHANES / Medimaps)

TBS L1-L4: 1.259



TBS Mapping



Non diagnostic image

Medical Imaging Center

557 Ocean Boulevard - 97212 - Portland

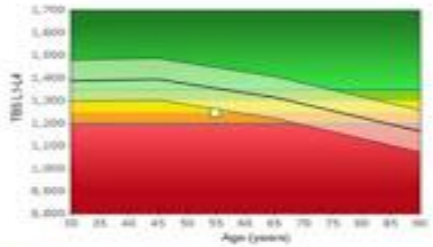
Patient :	Test1, Test1	Patient ID:	
Date of birth:	01/01/1960 - 54.7 years	Acquisition date:	29/09/2014
Height / Weight:	165.1 cm / 60.0 kg	Prescribing doctor:	—
Gender / Ethnicity:	Female / White		

SPINE TBS REPORT

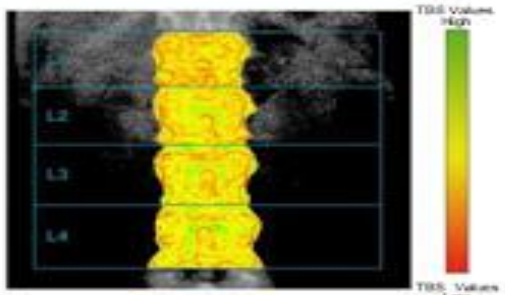
TBS reference graph

Reference population: USA

TBS L1-L4:1,249



TBS Mapping



Non-diagnostic image

Additional results

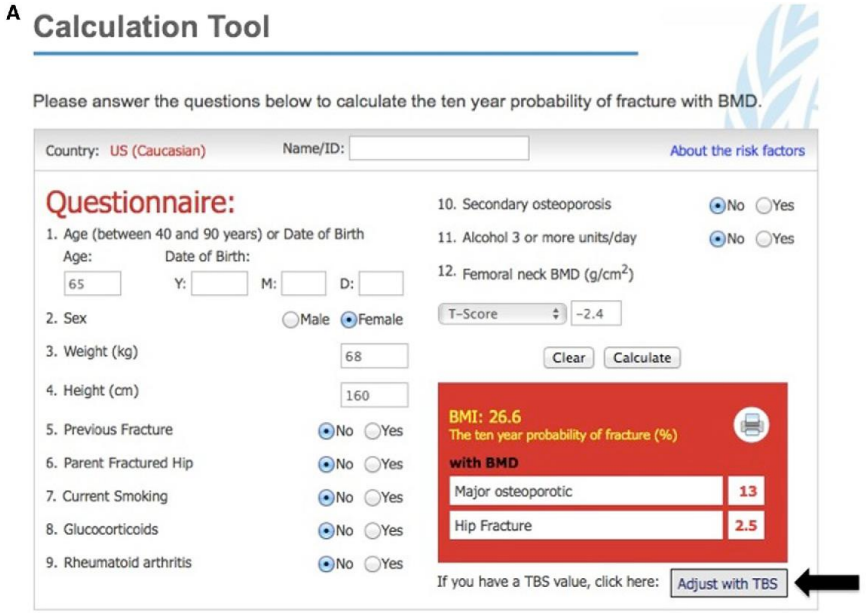
Region	TBS	SMD	BMD T-Score
L1	1,056	1,207	—
L2	1,257	1,261	—
L3	1,321	1,284	0.0
L4	1,382	1,297	0.0
L1-L4	1,249	1,265	—
L1-L3	1,211	1,252	0.0
L1-L2	1,156	1,235	0.0
L2-L4	1,313	1,282	0.0
L2-L3	1,289	1,273	0.0
L3-L4	1,341	1,291	0.5

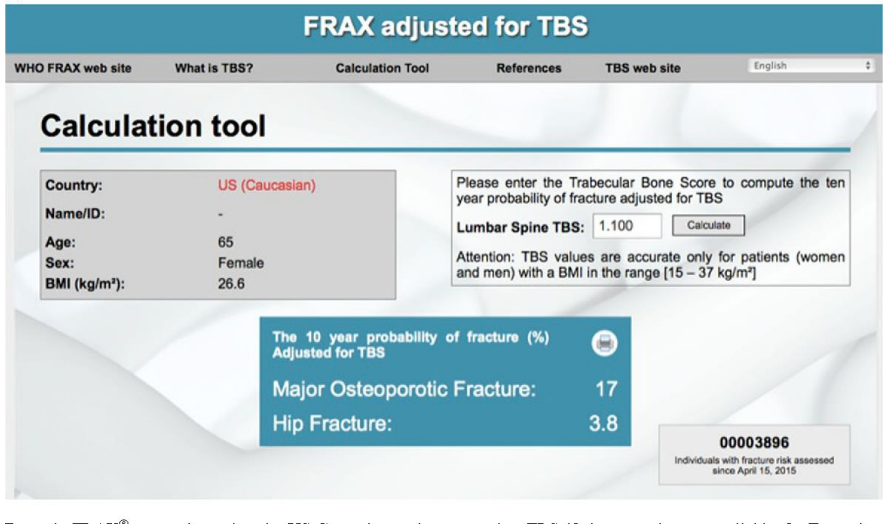
Comments

The TBS is derived from the texture of the DXA image and has been shown to be related to bone microarchitecture and fracture risk.
This data provides information independent of BMD value. It is used as a complement to the data obtained from the DXA analysis and the clinical examination. The TBS score can assist the health care professionals in assessment of fracture risk and in monitoring the effect of treatments on patients across time.
Overall fracture risk will depend on many additional factors that should be considered before making diagnostic or therapeutic recommendations.
The software does not diagnose disease or recommend treatment regimens. Only the health care professional can make these judgments.
DXA file "aspine1003.mas" (TBS analysis done on 29/09/2014, version 3.1.1.0)
This DXA system has not been calibrated with a specific TBS phantom. The TBS score has been computed with a generic calibration.
These results can be used at the sole discretion of the physician.

medimaps

TBS can now be applied to FRAX.





3D DXA

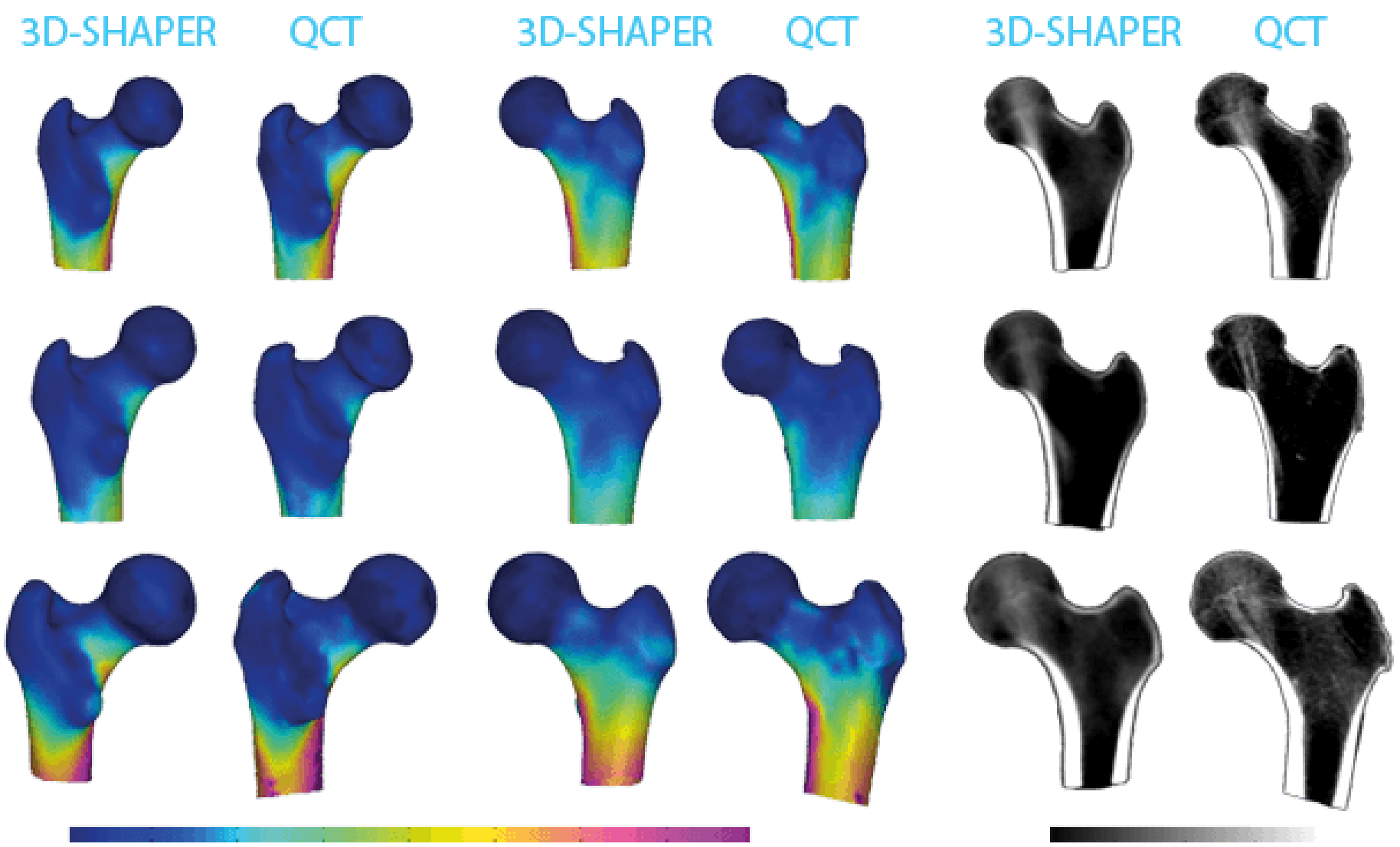
3D-SHAPER is a software application that registers a 3D statistical model onto the hip DXA scan of the patient and uses a model-based algorithm to create a 3D map of the cortical surface density. It allows clinicians to assess the cortical and trabecular macrostructure in 3D from a standard hip DXA scan.

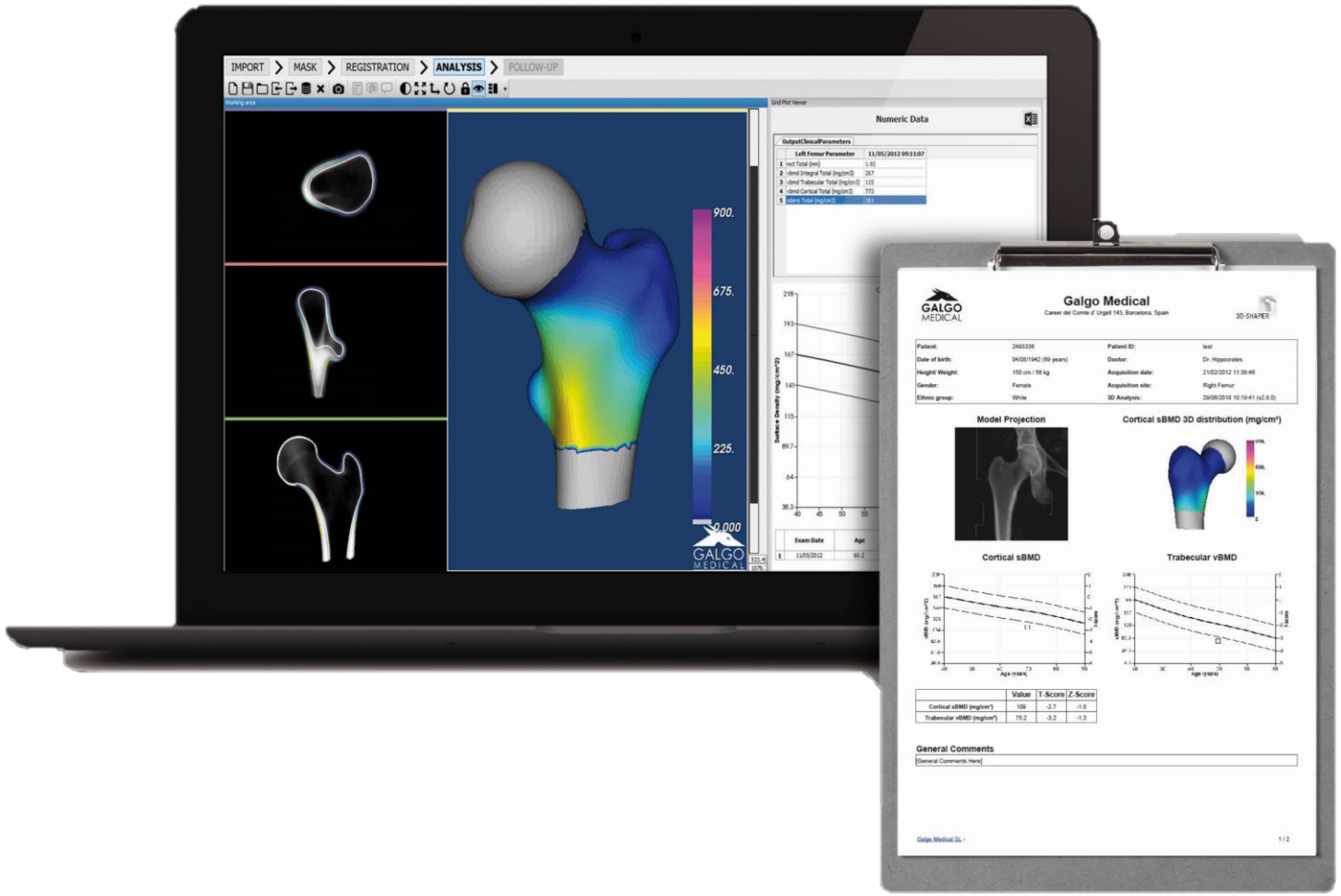
3D DXA

Incorporates a statistical model built from a database of quantitative computed tomography scans.

Registers the statistical model onto the DXA projection of the patient. The algorithm maximizes the similarity between the projection of the model and the DXA image

Estimates the cortical thickness and density by the fitting a mathematical function onto the density profiles measured along the normal vector at each vertex of the femoral shape


3D-SHAPER
QCT
3D-SHAPER
QCT
3D-SHAPER
QCT


IMPORT
MASK
REGISTRATION
ANALYSIS
FOLLOW-UP
Numeric Data
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675.
450.
225.
0.000
GALGO MEDICAL
Galgo Medical
Career del Comte d' Urgell 143, Barcelona, Spain
3D-SHAPER
Model Projection
Cortical sBMD 3D distribution (mg/cm³)
Cortical sBMD
Trabecular vBMD
Value
T-Score
Z-Score
Cortical sBMD (mg/cm³)
Trabecular vBMD (mg/cm³)
General Comments
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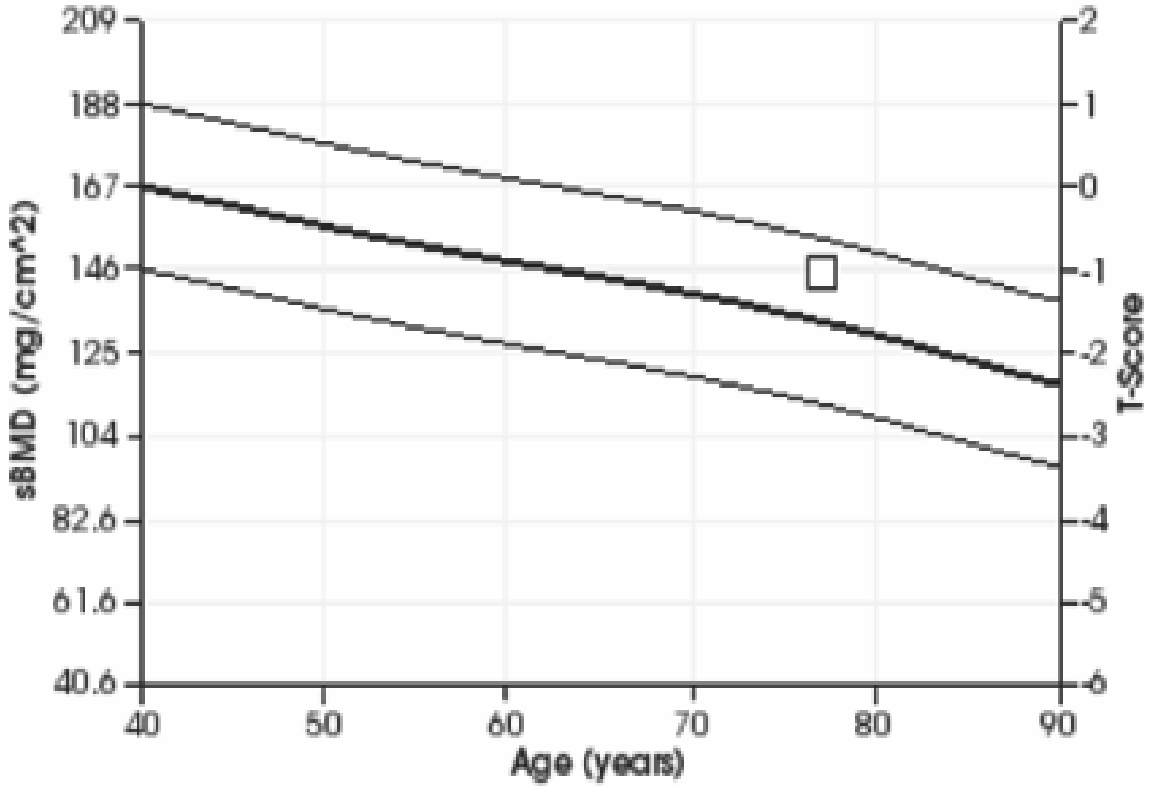
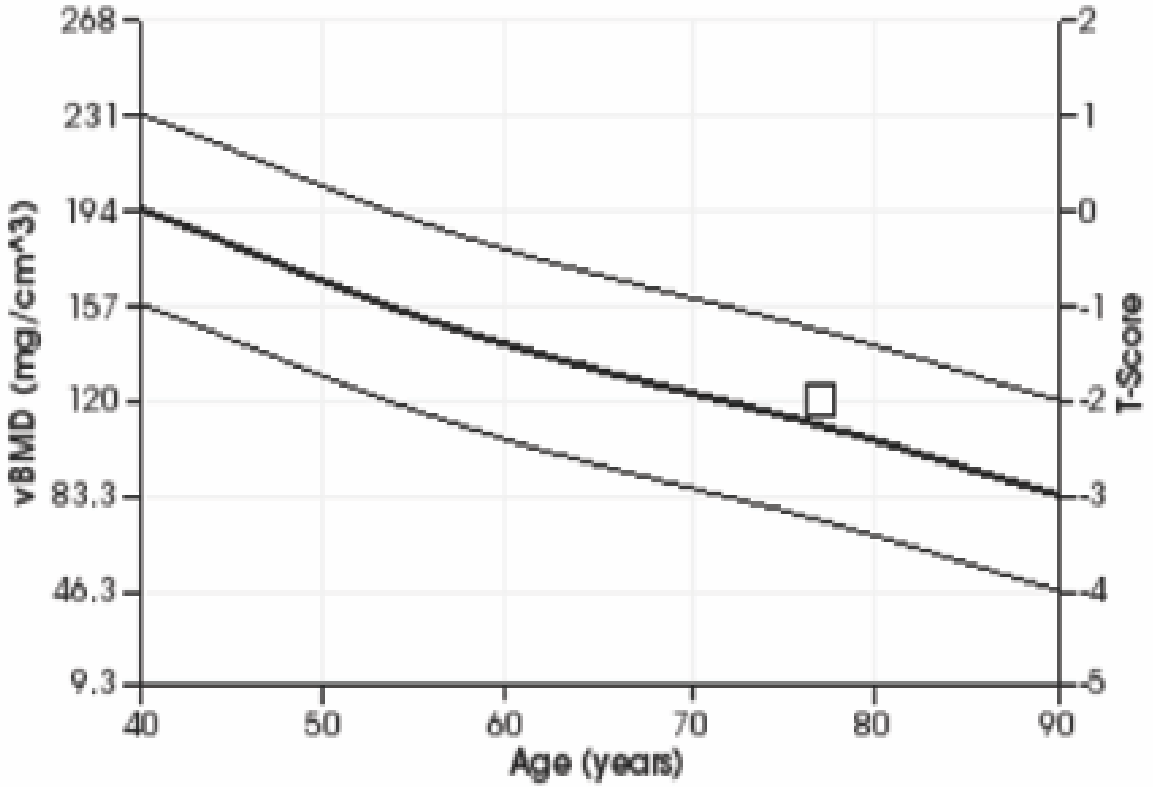
Galgo Medical SL -
1 / 2

Cortical sBMD

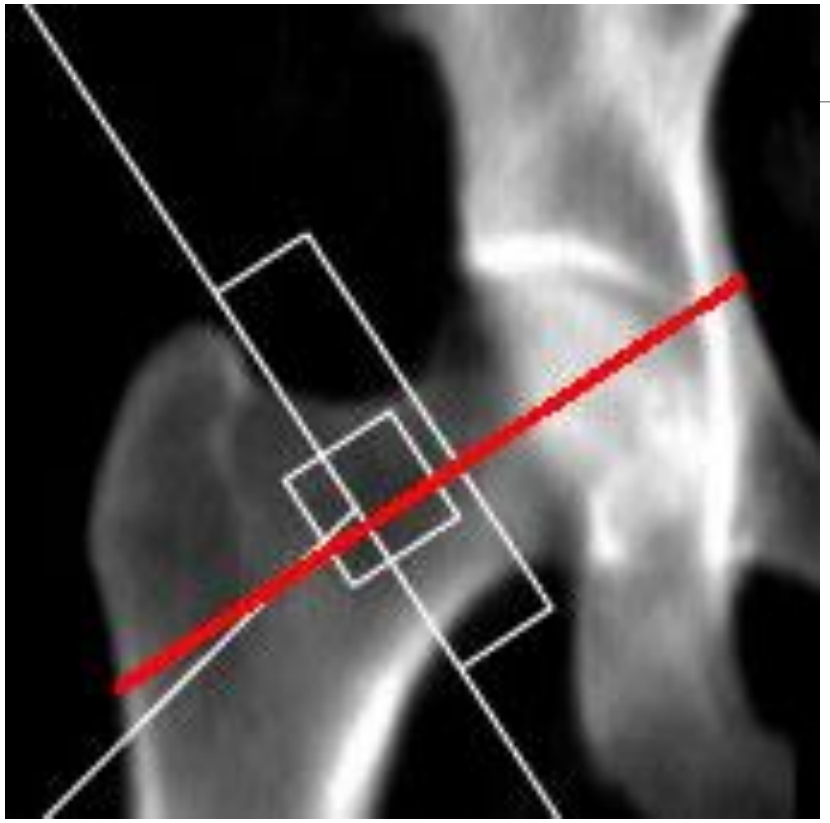


Trabecular vBMD



	Value	T-Score	Z-Score
Cortical sBMD (mg/cm²)	145	-1.0	0.6
Trabecular vBMD (mg/cm³)	120	-2.0	0.3

Hip Structure Analysis (HSA)



Hip Axis Length (HAL)

Geometric measurements might be used together with densitometric evaluations for a better assessment of hip fracture risk

Measures length and angle of hip axis

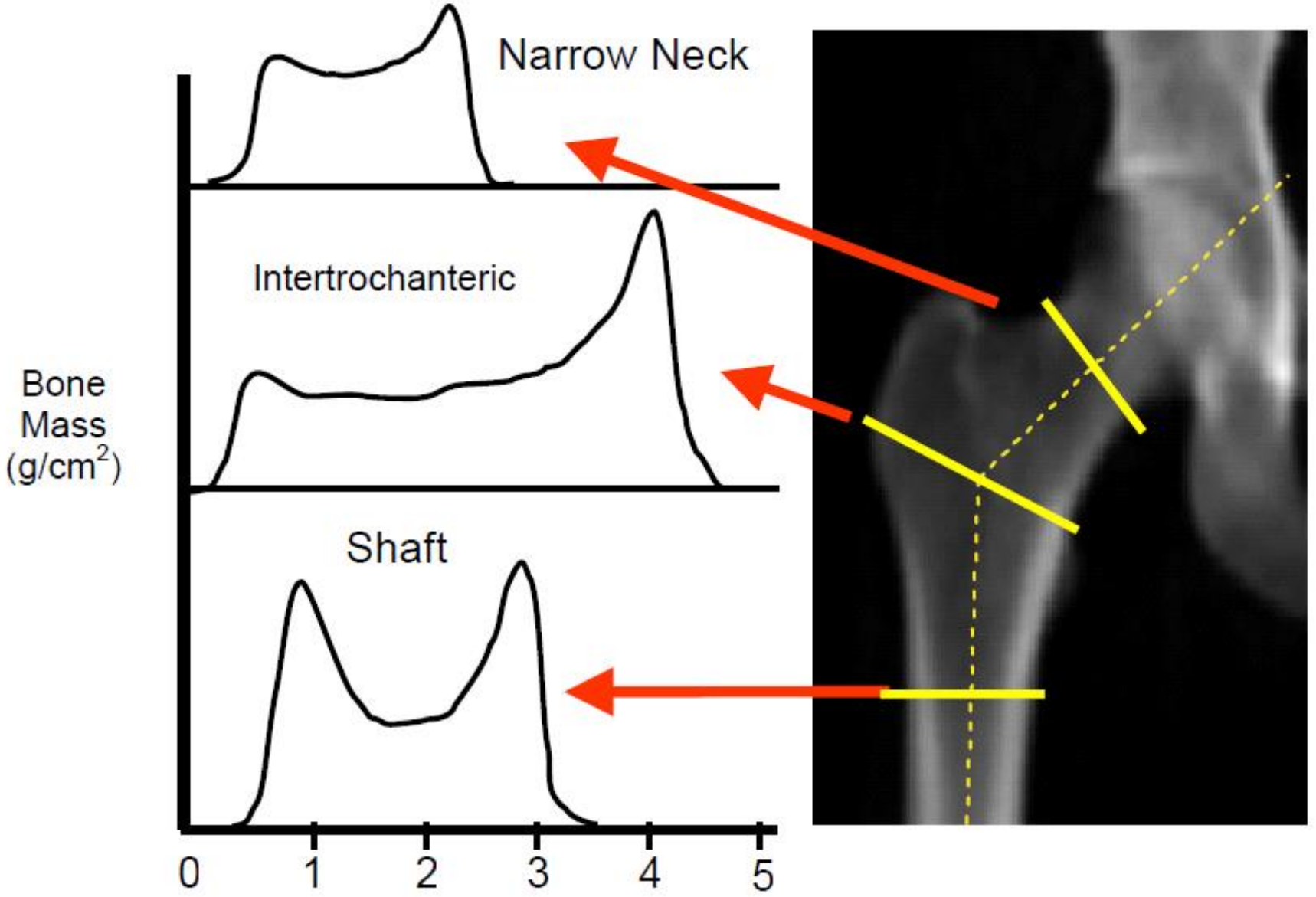
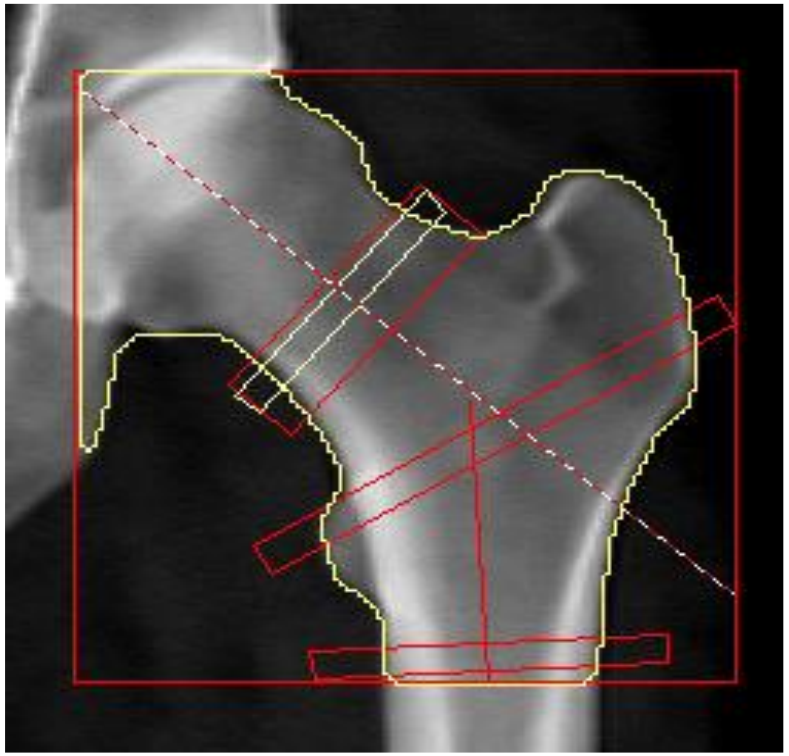


Figure 1: Hip image from a Hologic DXA scanner showing positions of thin analysis regions across the femur at the neck (NN region), intertrochanteric (IT) and shaft. On the left are shown typical bone mass profiles used in measurements of geometric properties.

HSA

As HAL increases, fracture risk increases

Each centimeter (10%) increase in Hip Axis length (HAL) increases hip fracture by 50-80% depending on the study

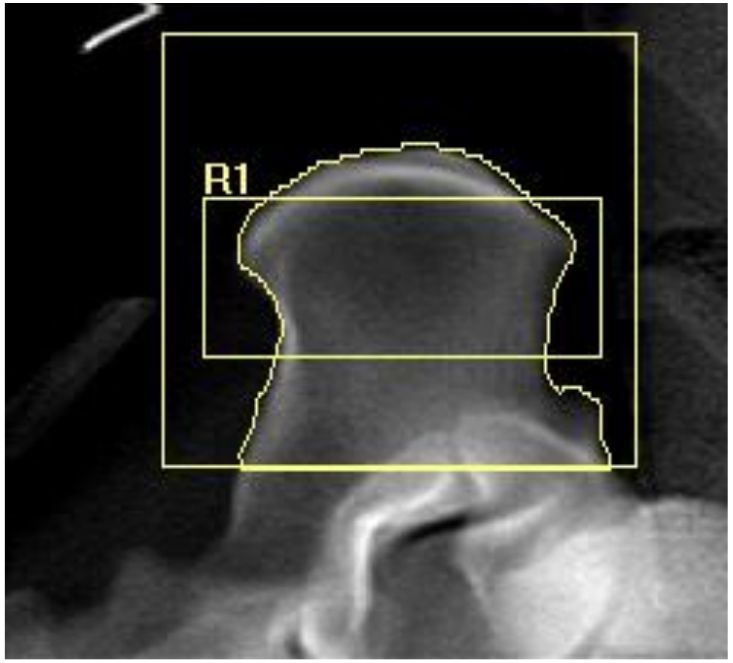


HSA™ Results Summary:

Region	Sub Peri. Width(cm)	Endo Cort. Width(cm)	CSA (cm^2)	CSMI (cm^4)	Z (cm^3)	Cort. Thick (cm)	BR
NN	3.84	3.46	3.66	4.31	2.02	0.19	11.2
IT	7.07	5.97	7.89	30.40	7.35	0.55	7.5
FS	3.47	2.12	5.90	6.15	3.44	0.67	2.7
Neck Shaft Angle:	134°						
HAL:	115 mm						

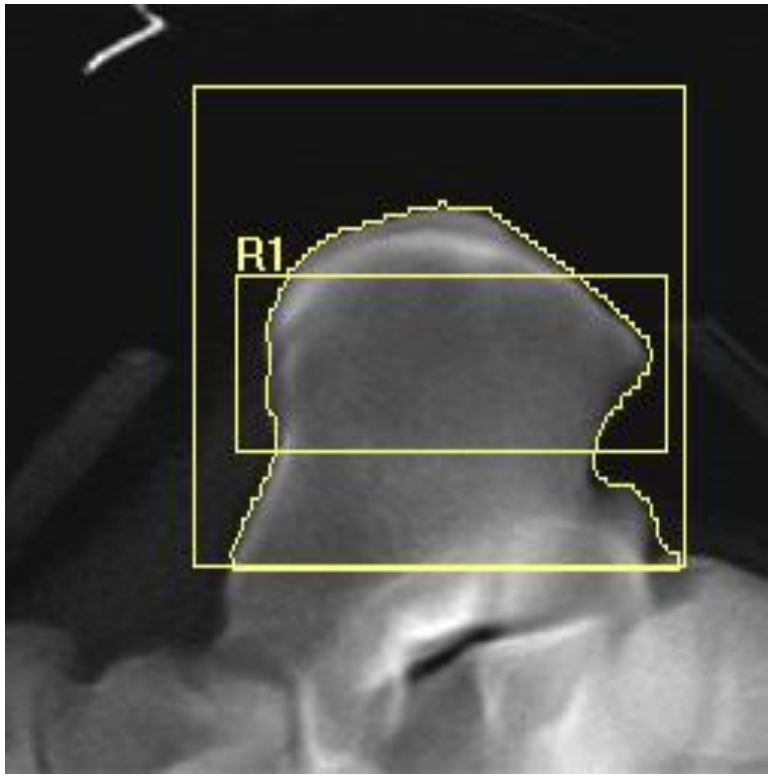
Used forearm protocol.

You can use other protocol to examine other skeletal areas. You just won't get a T-Score

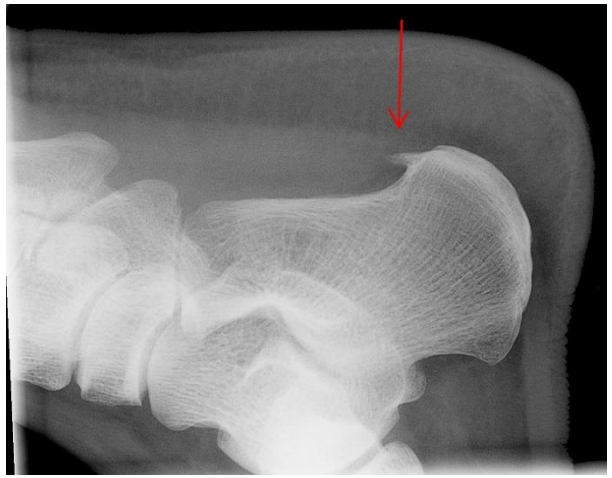


Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)
GLOBAL	23.32	18.50	0.794
R1	11.95	7.65	0.641
Net	**11.95**	**7.65**	**0.641**

Normal Heel



Heel Bone Spur



Sign of Previous trauma to Ankle