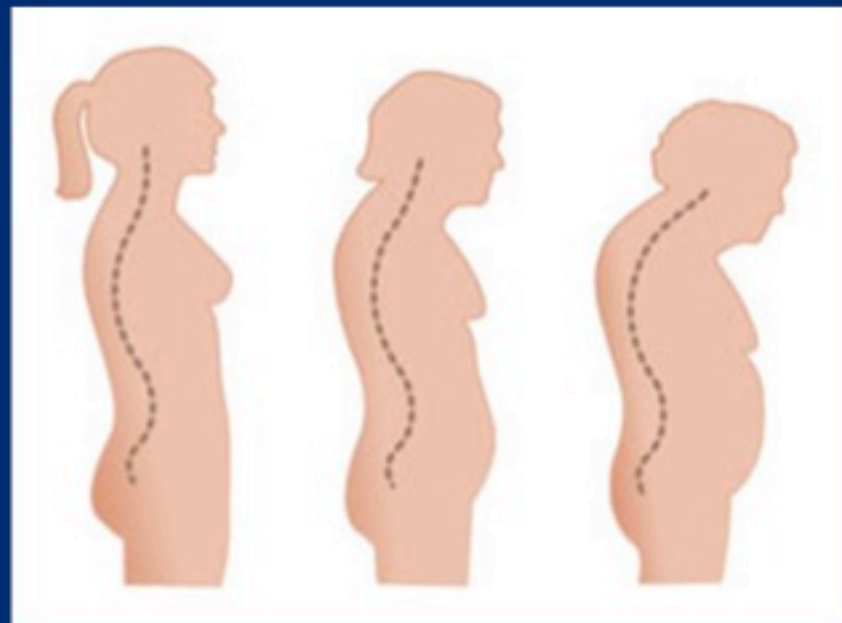
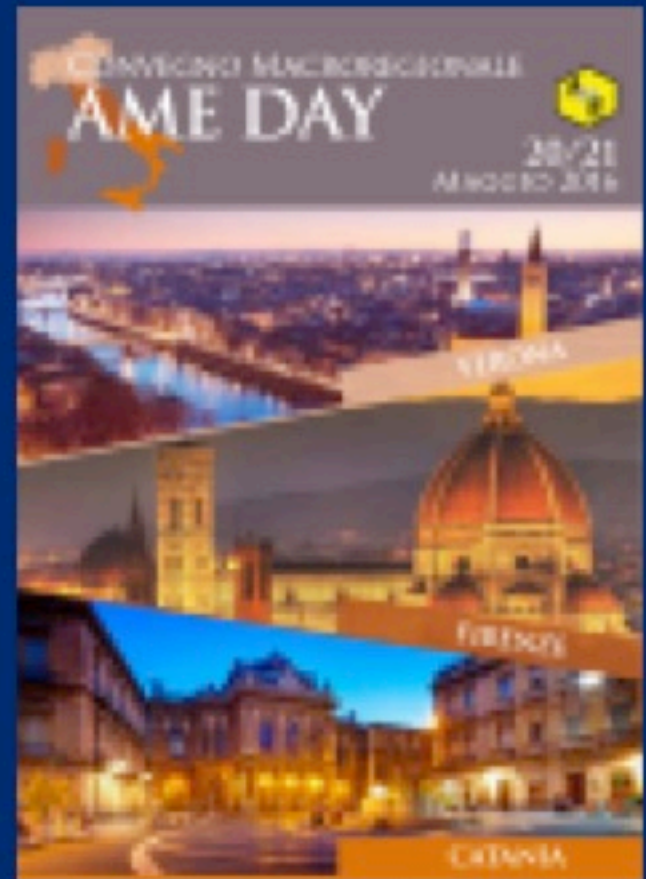




*Dr.ssa V. Camozzi*  
*UOC Endocrinologia*  
*AOU Padova*  
*Direttore Prof. M. Boscaro*



*Valutazione di base del paziente*  
*Clinica, Radiologia, Laboratorio, DXA*

# Sintomatologia



## Rachialgia

- Da carico: distinta dalla rigidità mattutina e dal dolore notturno
- Origine ossea
- Origine muscolare

La rachialgia può anche derivare dalla contrattura muscolare, e dallo stiramento/compressione sui legamenti posteriori e le faccette articolari.

Il paziente sente improvvisamente **un dolore acuto**, spesso associato a una sensazione di “incrinatura” nella schiena.

**Il dolore spesso peggiora con il movimento e la stazione eretta** e si attenua con il riposo

**le fratture “silenti”** non sono rare:

dopo un periodo di dolore al rachide  
il paziente migliora nel tempo e dimentica l'episodio.

Un esame radiologico, effettuato successivamente per altri motivi, può rilevare la frattura, ormai asintomatica.

**Nel frattempo può essere stata richiesta  
una densitometria che di certo non è dirimente**

# Le fratture vertebrali: clinica



Ospedalizzazione

2-10 %

Diagnosi clinica

40 %

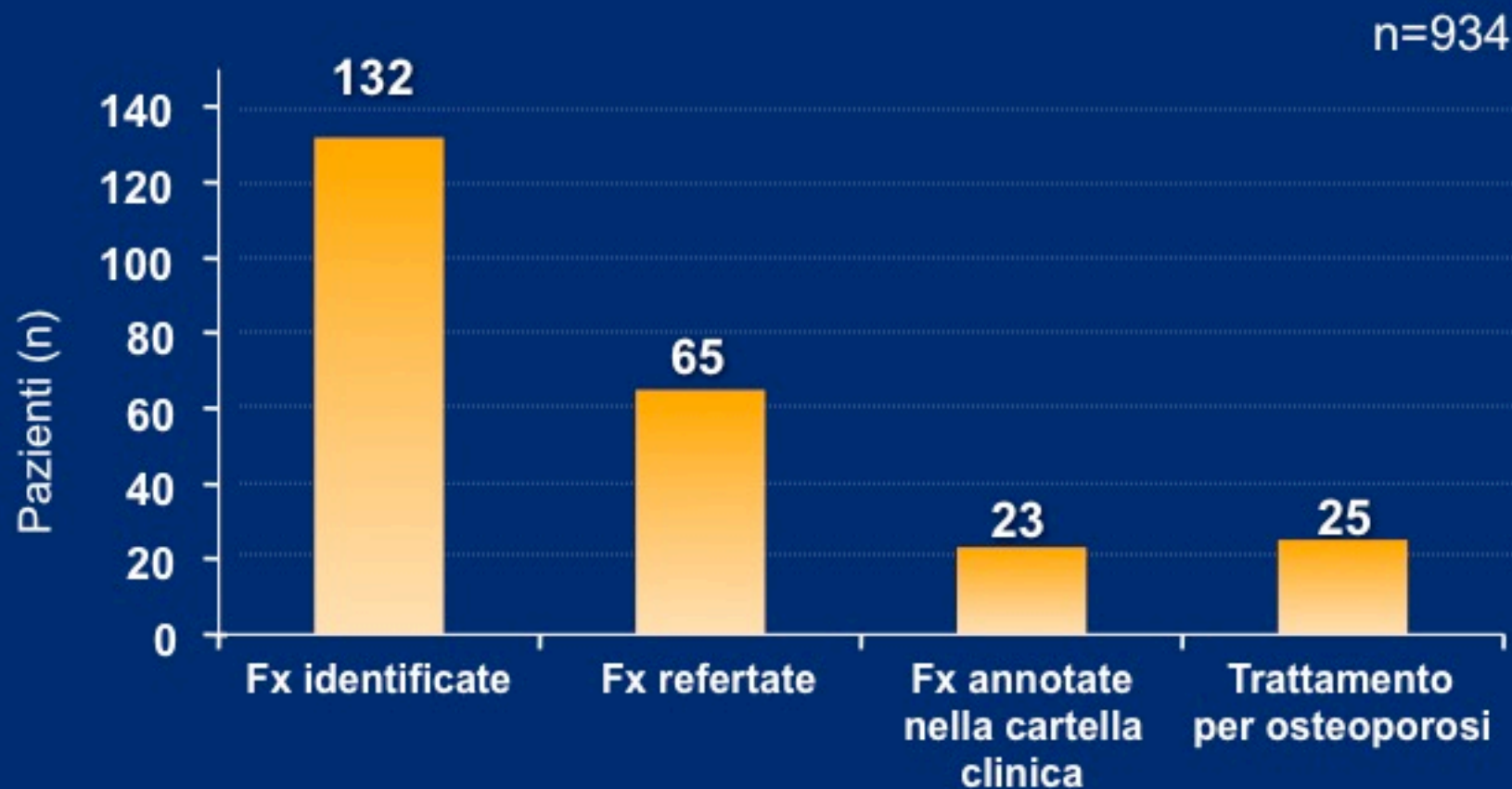
Fratture vertebrali

100 %

## Perché le fratture vertebrali non vengono riconosciute

- La sintomatologia viene spesso confusa con quella relativa ad altre malattie del rachide
- L'attenzione verso una appropriata diagnosi radiologica è ancora inadeguata
- Possono essere pauci-sintomatiche

# Riconoscimento delle fratture vertebrali in pazienti ricoverati





Non è raro dopo una caduta trovare una RX negativa

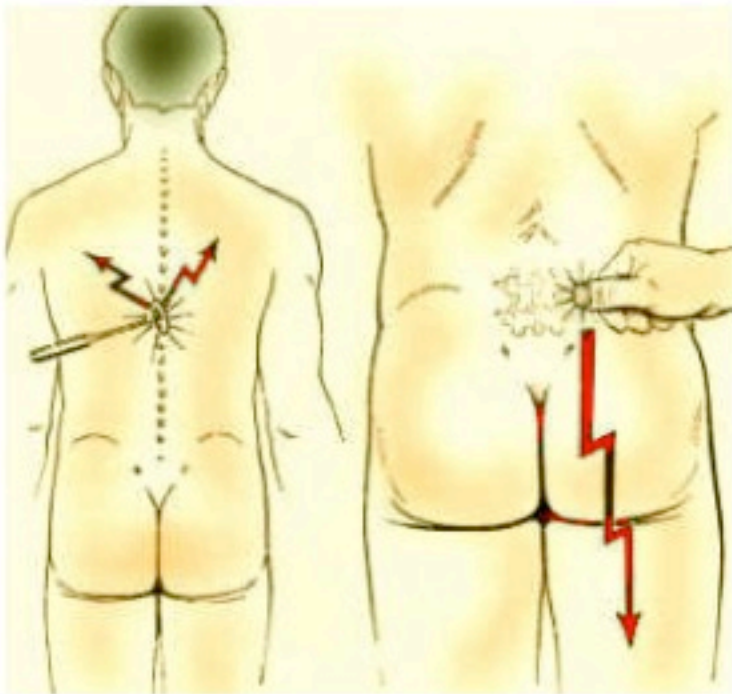
La RM precede l'evidenza della frattura rispetto alla RX standard



RX dopo un mese dalla caduta

La dolorabilità alla percussione, quando presente,

- spesso indicativa di un trauma recente
- può contribuire a differenziare una frattura acuta da una di vecchia data .



➤ TAC

➤ RM

Nella diagnostica differenziale



# Caratteristiche cliniche della frattura vertebrale da fragilità acuta

## *Evento precipitante*

**%**

Nessuno	46
Lieve	36
Moderato	10
Severo	7

## *Dolore*

Localizzato	63
Diffuso	23
Irradiato fianchi/addome	75
Irradiato alle gambe	7

## *Dolore alleviato in posizione*

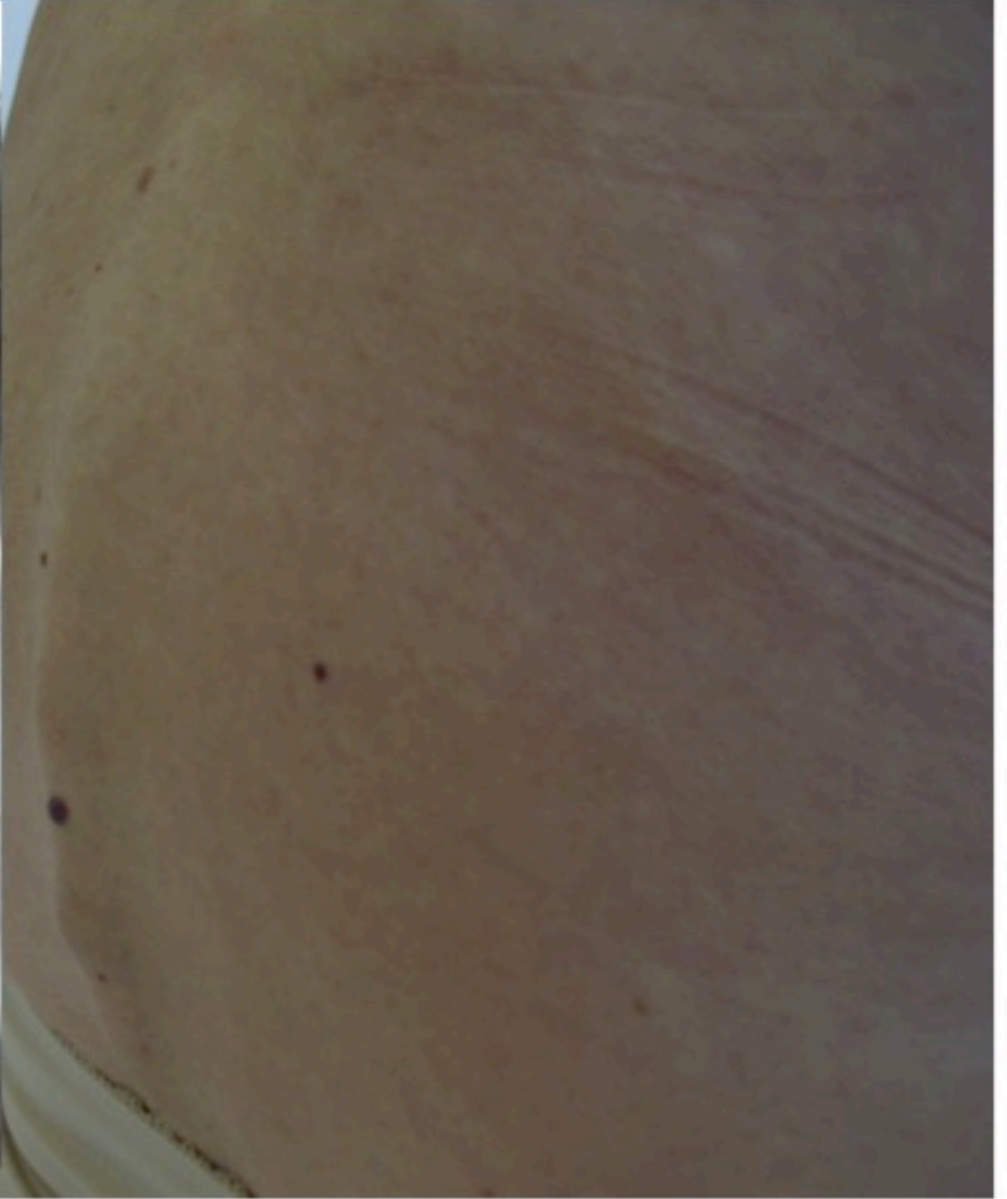
Supina	43
Seduta	37
Eretta	17

## Oltre il dolore

### 1) Calo staturale

- La pz vi dice che in gioventù era alta 10 cm più della misurazione attuale
- Al controllo annuale la pz è diminuita ancora in altezza (> 1 cm)

### 2) La paziente presenta un'evidente cifosi



**Normal  
(grade 0)**



**Mild fracture  
(grade 1, 20–25%)**

**Wedge fracture**



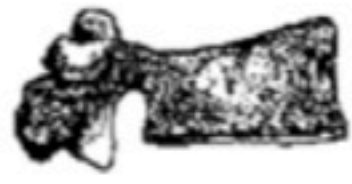
**Biconcave fracture**



**Crush fracture**



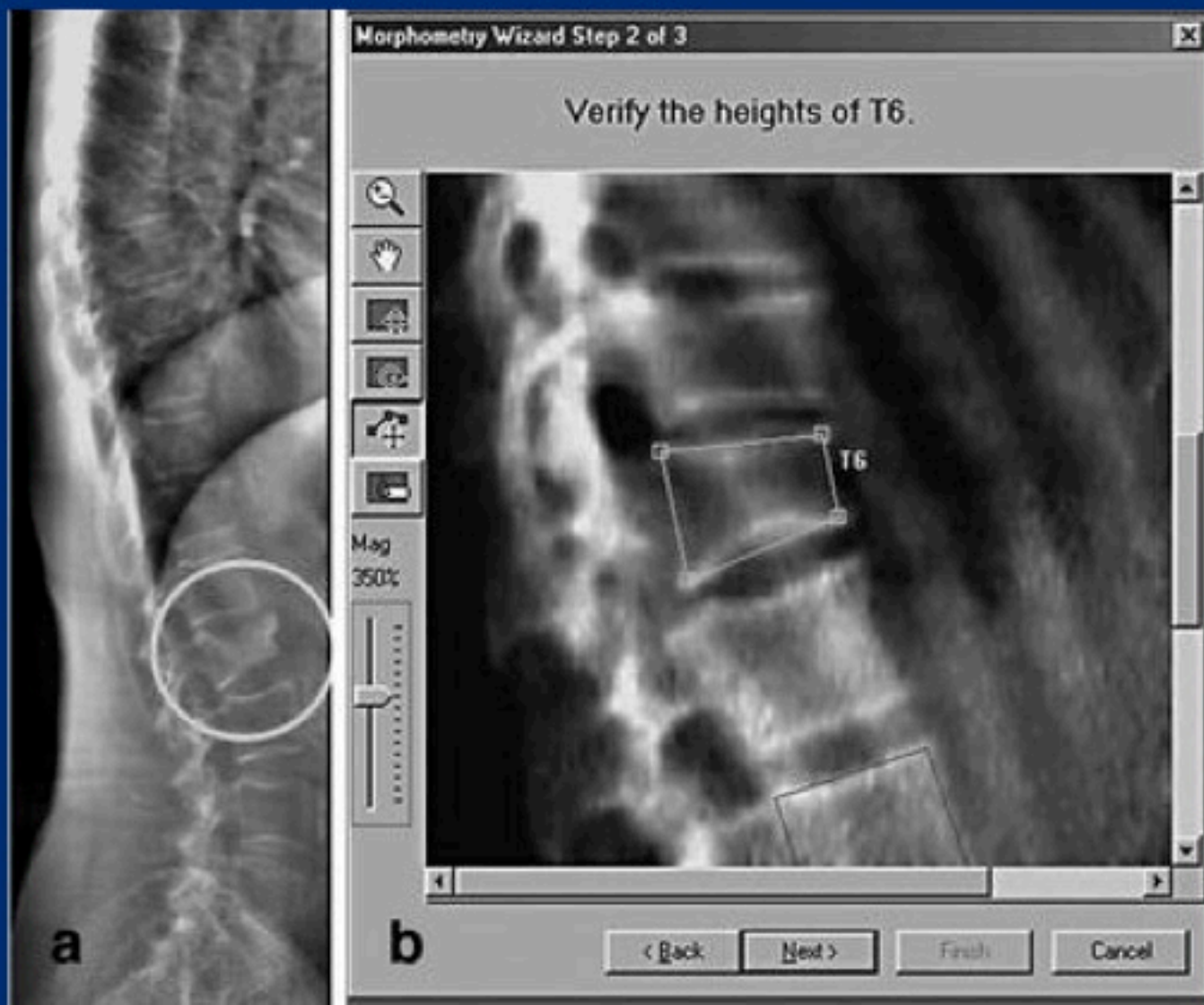
**Moderate fracture  
(grade 2, 26–40%)**



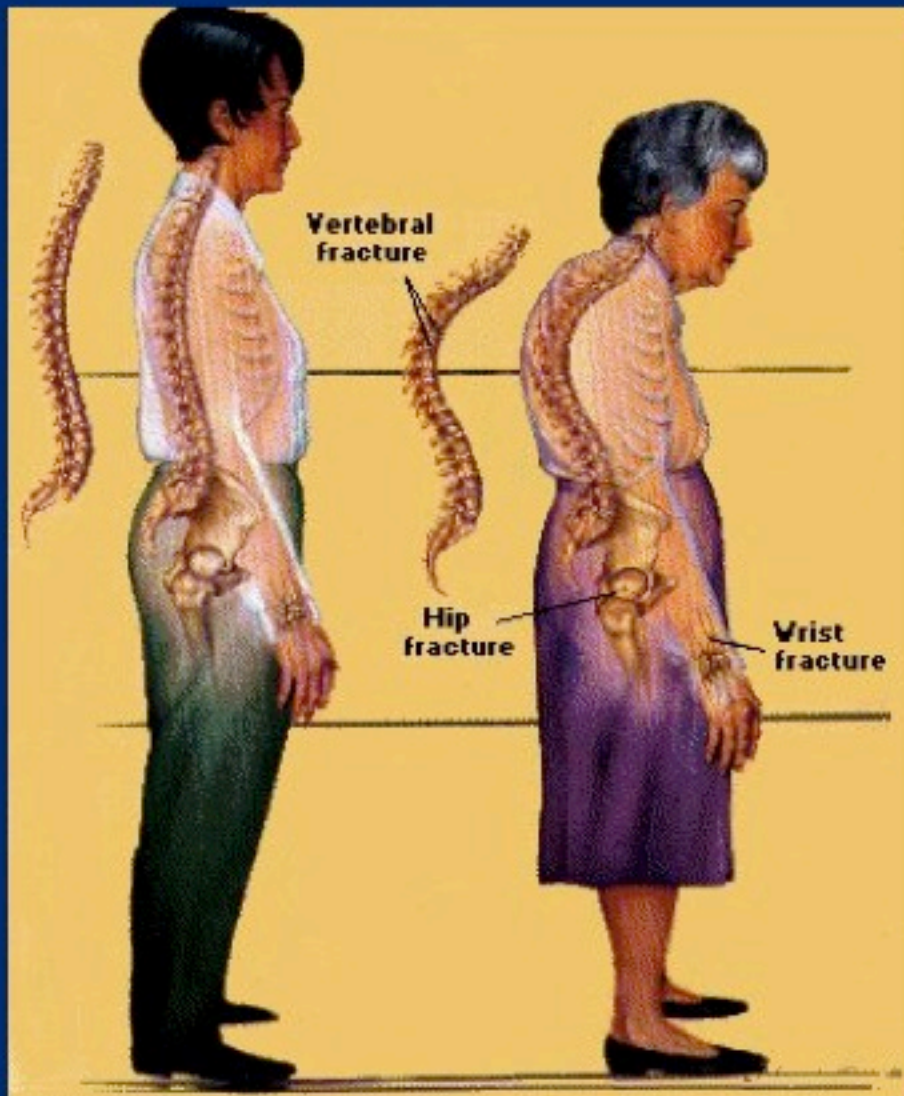
**Severe fracture  
(grade 3, > 40%)**




# Metodo Quantitativo: Analisi Morfometrica



# Conseguenze delle fratture vertebrali



- ◆ Dolore vertebrale cronico
  - spondiloartrosi secondaria
  - compromissione del canale midollare portando a danno neuronale
- ◆ Riduzione dei volumi polmonari
- ◆ Protrusione addominale (senso precoce di sazietà, perdita di peso)
- ◆ Perdita dell' autostima, depressione
- ◆ Dipendenza dagli analgesici
- ◆ Aumento della mortalità
- ◆ Aumento del rischio di nuove fratture

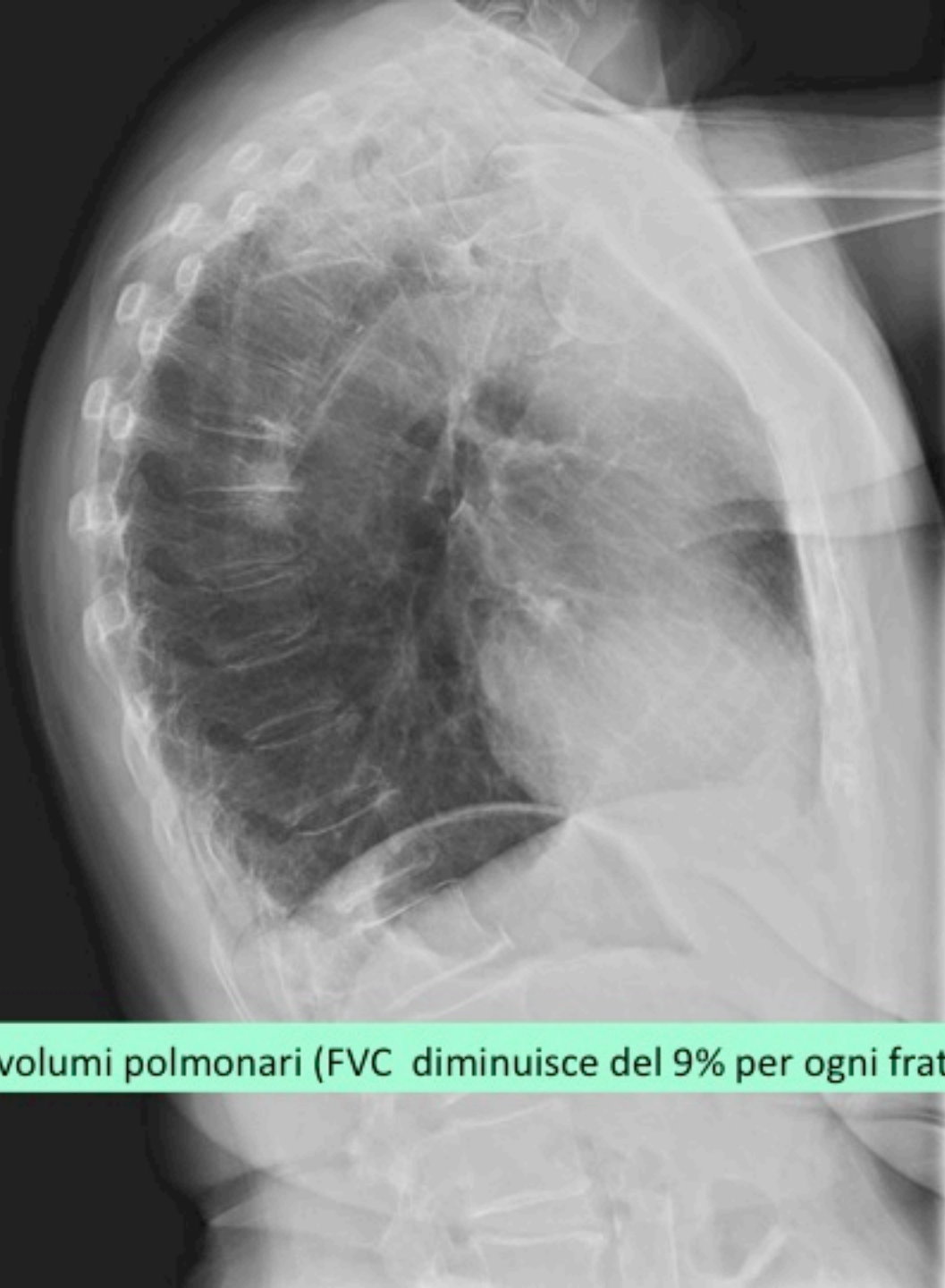
A lateral X-ray of the spine showing significant degenerative changes, including disc space narrowing and osteophyte formation, which can lead to nerve root compression. The image is oriented vertically, showing the spine from the neck down to the pelvis. A light green text box is overlaid on the lower portion of the image.

Complicanze artrosiche con compressione della radice nervosa che può causare ulteriore dolore alle gambe e glutei





Riduzione  
dei  
volumi  
polmonari

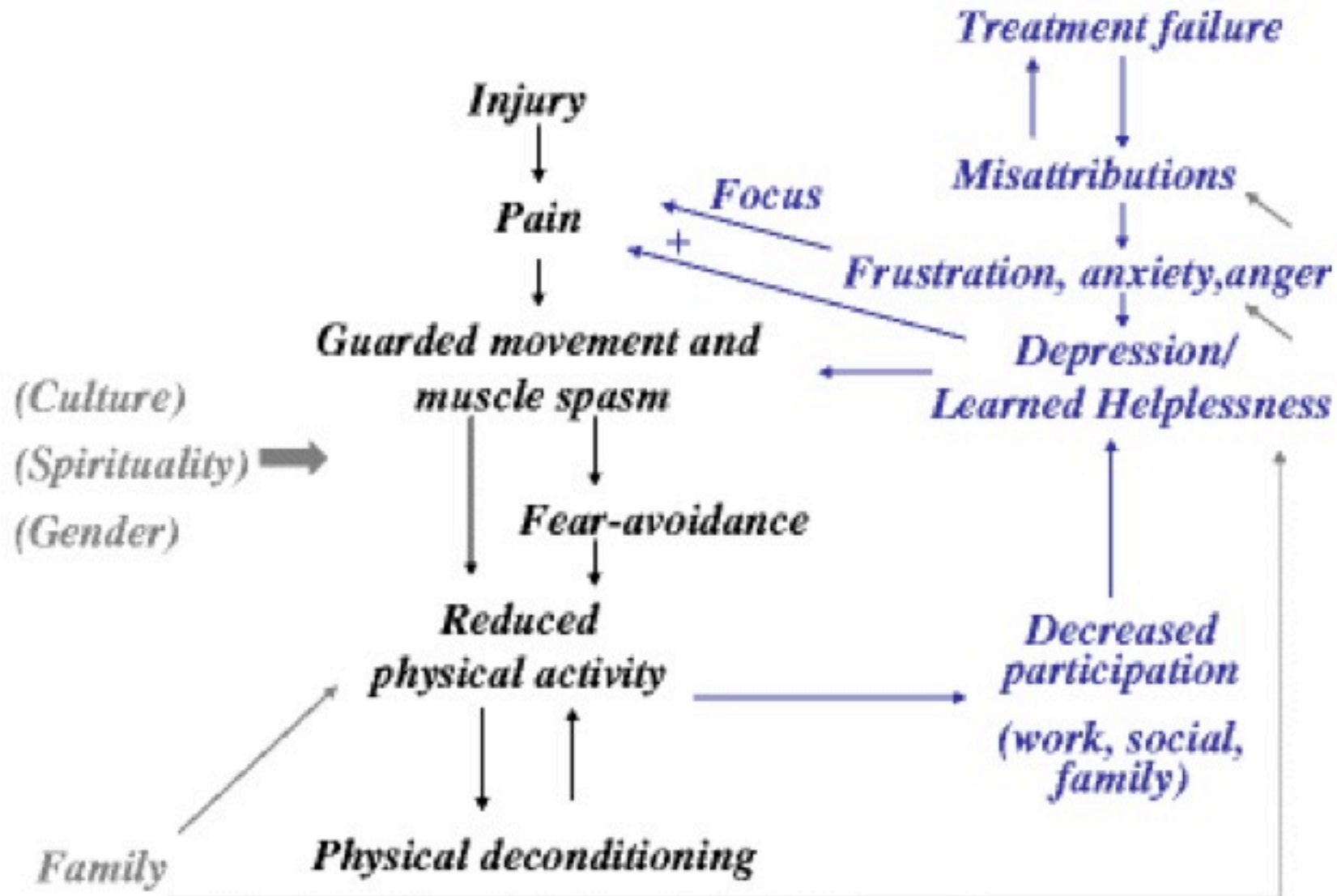


Riduzione dei volumi polmonari (FVC diminuisce del 9% per ogni frattura vertebrale)

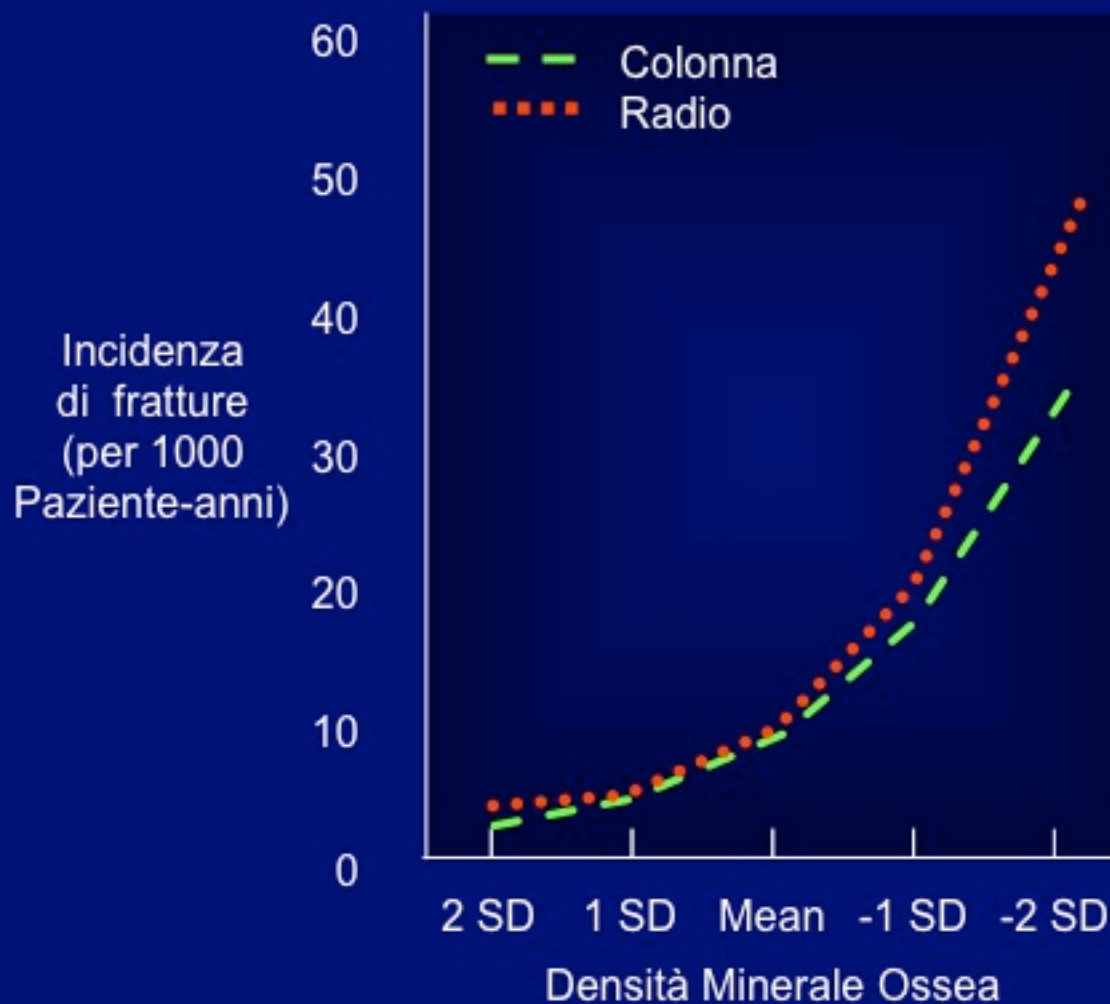


Talora si determinano deformazioni importanti con flessione in avanti e spostamento laterale del centro di gravità e conseguente perdita di equilibrio

## Circolo vizioso del dolore



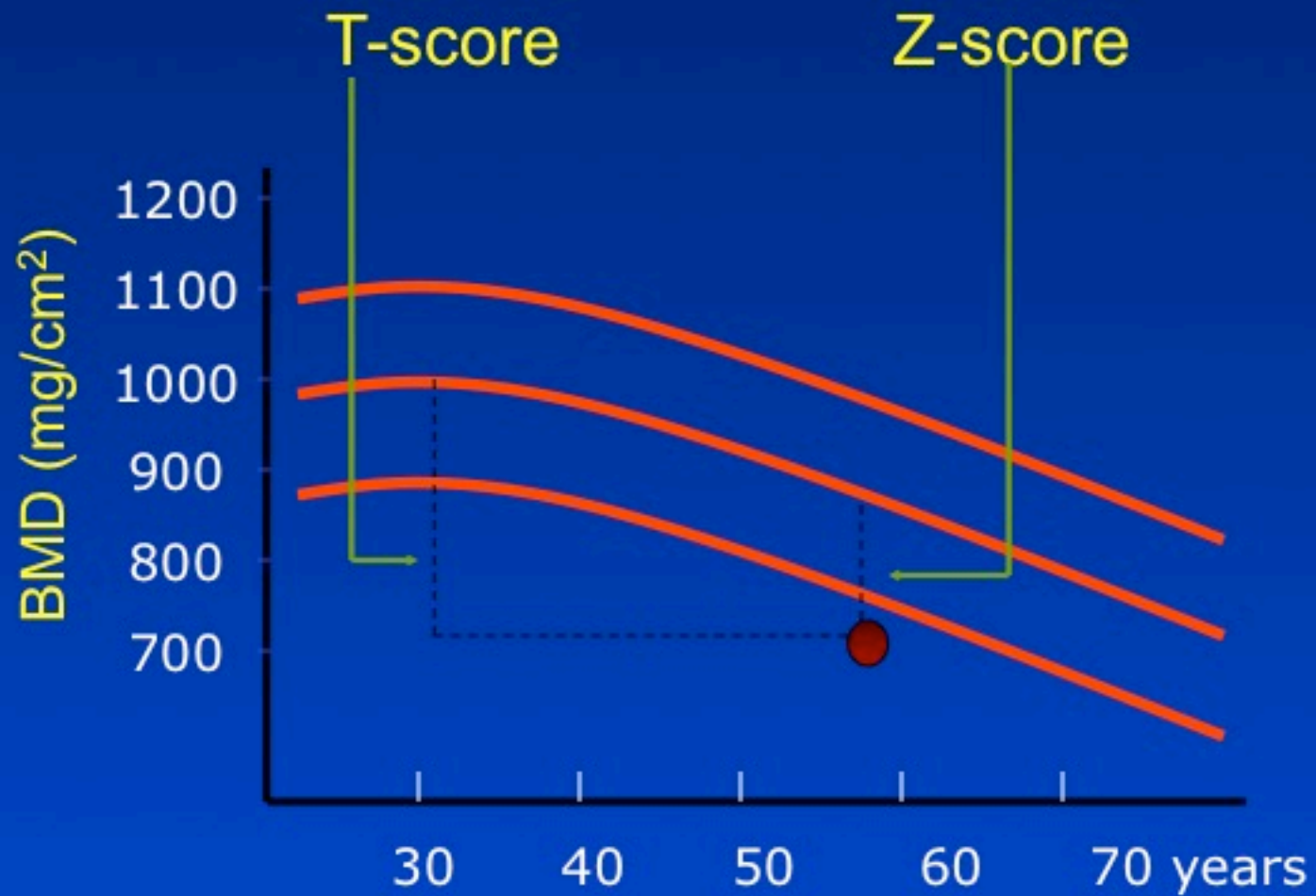
# Rischio di frattura e BMD



Relazione esponenziale tra diminuzione della BMD e aumento del rischio di frattura.

## Densitometria ossea a raggi X - DEXA





# IL RISCHIO RELATIVO DI FRATTURA PER 1DS DI RIDUZIONE DELLA DENSITÀ MINERALE

Siti di Misurazione DXA	SITI DI FRATTURA		
	Polso	Femore	Vertebre
Polso	1,8	1,6	1,6
Collo femorale	1,6	2,6	1,9
Colonna lombare	1,6	1,3	2,0

## Total body ?

- Modeste variazioni nel tempo
- Osso prevalentemente corticale (80%)
- Scarsa precisione nella riproducibilità dei singoli segmenti
- Non vi sono studi sulla correlazione fra densità ossea total body e fratture

### Indicazioni:

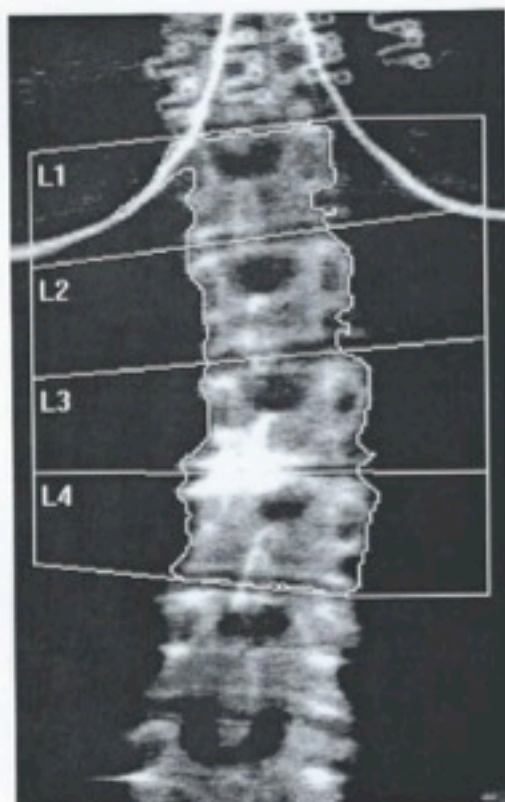
- Bambini
- Gravi malformazioni scheletriche



# DENSITOMETRIA: A CHI

- ✓ **Alla menopausa ?**
- ✓ **Precedenti fratture da fragilità**
- ✓ **Donne con storia familiare di fratture da fragilità**
- ✓ **Donne con BMI <19 Kg/m<sup>2</sup>**
- ✓ **Condizioni cliniche associate ad osteoporosi**  
*(m. endocrine; m. ematologiche; m. gastroenteriche; m. reumatiche)*
- ✓ **Previsione di trattamento >3 mesi con glucocorticoidi**  
*(o con altri farmaci a nota azione osteopenizzante: eparine,...)*
- ✓ **Menopausa precoce (<45 anni)**
- ✓ **Amenorrea secondaria (>12 mesi)**
- ✓ **Uomini: se presenti fattori di rischio**

Referring Physician: CAMOZZI



116 x 122

**Scan Information:**

Scan Date: 11 December 2014 ID: A12111403

Scan Type: f Lumbar Spine

Analysis: 11 December 2014 14:18 Version 12.6

Lumbar Spine

Operator: WG

Model: Discovery W (S/N 70105)

Comment:

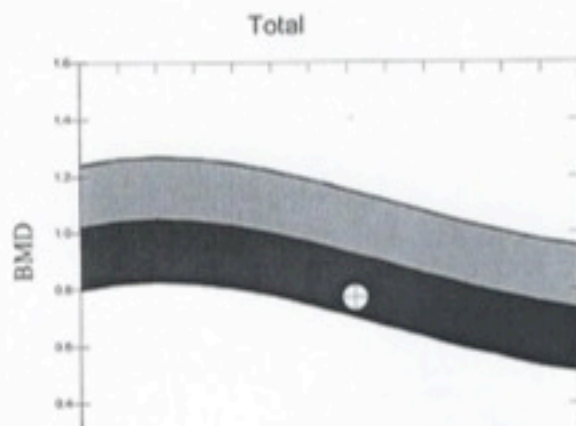
**DXA Results Summary:**

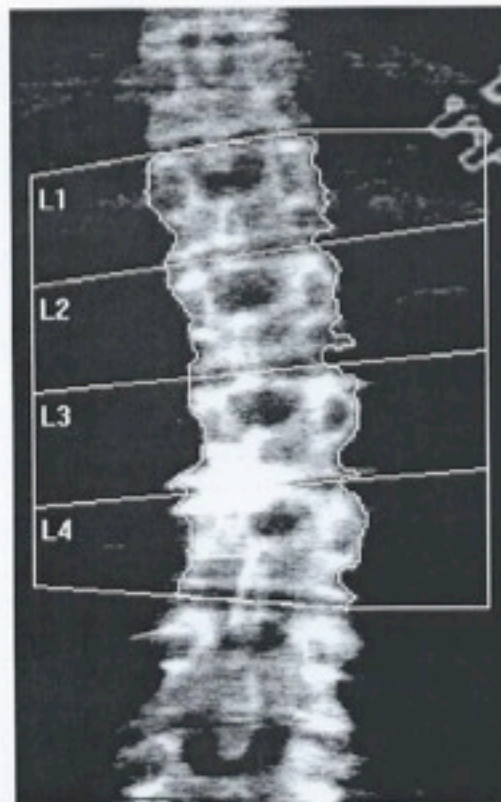
Region	Area (cm <sup>2</sup> )	BMC (g)	BMD (g/cm <sup>2</sup> )	T - score	PR (%)	Z - score	AM (%)
L1	10.60	6.10	0.576	-3.2	62	-2.2	71
L2	11.56	7.77	0.672	-3.2	65	-2.1	74
L3	12.46	11.04	0.885	-1.8	82	-0.6	93
L4	13.63	12.29	0.902	-1.9	81	-0.8	92
<b>Total</b>	<b>48.25</b>	<b>37.20</b>	<b>0.771</b>	<b>-2.5</b>	<b>74</b>	<b>-1.4</b>	<b>84</b>

Total BMD CV 1.0%

WHO Classification: Osteoporosis

Fracture Risk: High

**Physician's Comment:**



116 x 122

**Scan Information:**

Scan Date: 11 December 2014 ID: A12111404  
 Scan Type: f Lumbar Spine  
 Analysis: 11 December 2014 14:20 Version 12.6  
 Lumbar Spine (auto low density)  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

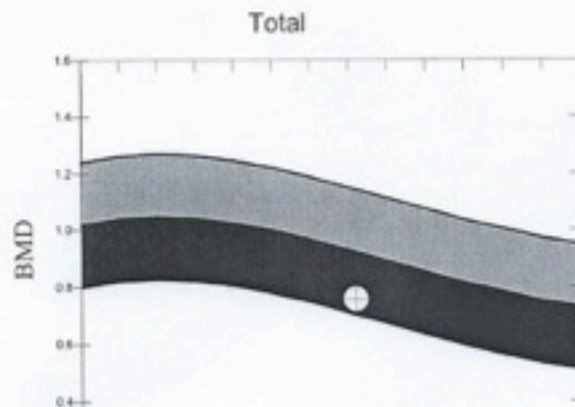
**DXA Results Summary:**

Region	Area (cm <sup>2</sup> )	BMC (g)	BMD (g/cm <sup>3</sup> )	T - score	PR (%)	Z - score	AM (%)
L1	12.13	6.20	0.511	-3.8	55	-2.8	63
L2	11.67	7.96	0.682	-3.1	66	-2.0	75
L3	12.05	10.97	0.911	-1.6	84	-0.4	95
L4	12.84	11.71	0.912	-1.9	82	-0.7	93
<b>Total</b>	<b>48.69</b>	<b>36.85</b>	<b>0.757</b>	<b>-2.6</b>	<b>72</b>	<b>-1.5</b>	<b>82</b>

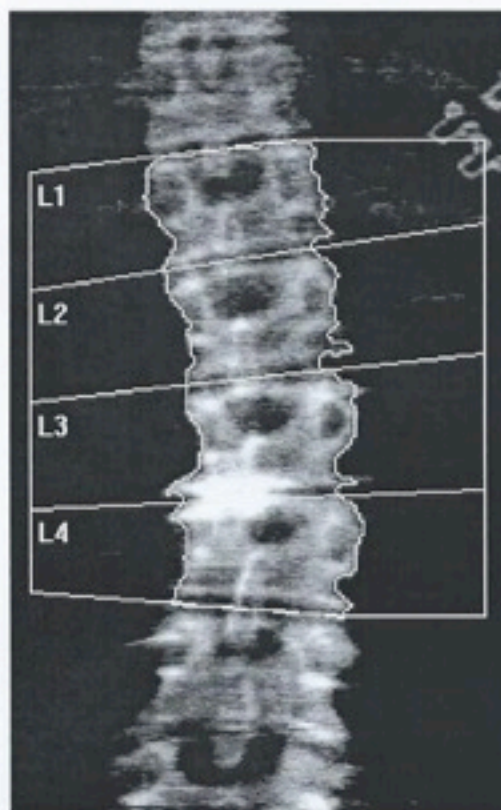
Total BMD CV 1.0%

WHO Classification: Osteoporosis

Fracture Risk: High



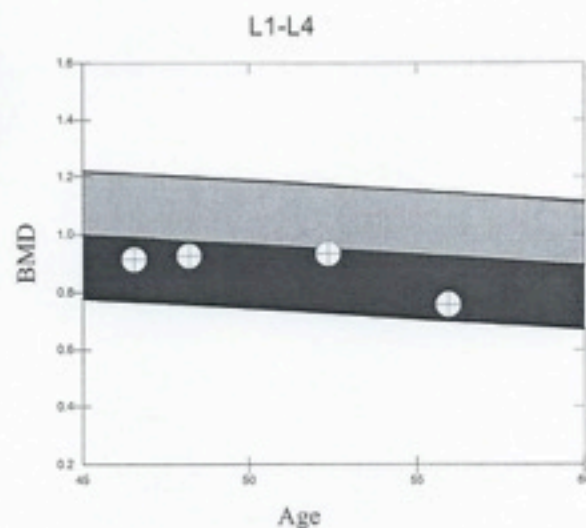
**Physician's Comment:**



116 x 121

**Scan Information:**

Scan Date: 11 December 2014 ID: A12111404  
 Scan Type: f Lumbar Spine  
 Analysis: 12 December 2014 19:58 Version 12.6  
 Lumbar Spine (auto low density)  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

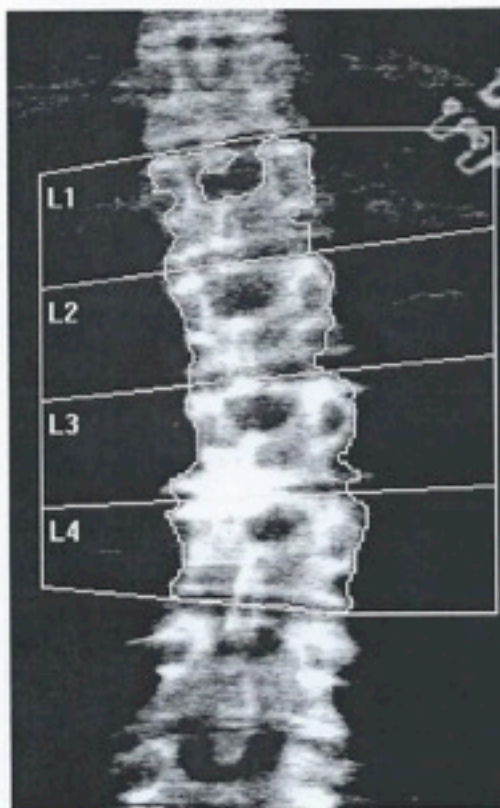
**DXA Results Summary: L1-L4**

T-score vs. White Female; Z-score vs. White Female. Source:Hologic

Scan Date	Age	BMD (g/cm <sup>2</sup> )	T - score	BMD Change vs Baseline	BMD Change vs Previous
11.12.2014	55	0.758	-2.6	-17.2%#	-18.9%#
19.05.2011	52	0.934	-1.0	2.1%	0.8%
22.03.2007	48	0.927	-1.1	1.3%	1.3%
25.07.2005	46	0.915	-1.2		

\* Denotes significance at 95% confidence level, LSC is 0.008060 g/cm<sup>2</sup>

# Denotes dissimilar scan types or analysis methods.



116 x 123

**Scan Information:**

Scan Date: 11 December 2014 ID: A12111404

Scan Type: f Lumbar Spine

Analysis: 12 December 2014 19:49 Version 12.6

Lumbar Spine

Operator: WG

Model: Discovery W (S/N 70105)

Comment:

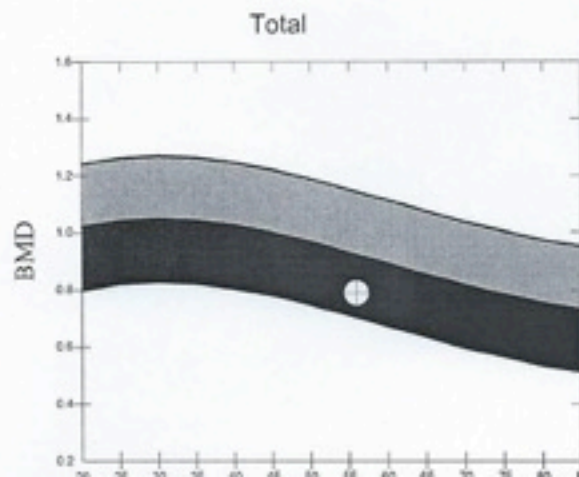
**DXA Results Summary:**

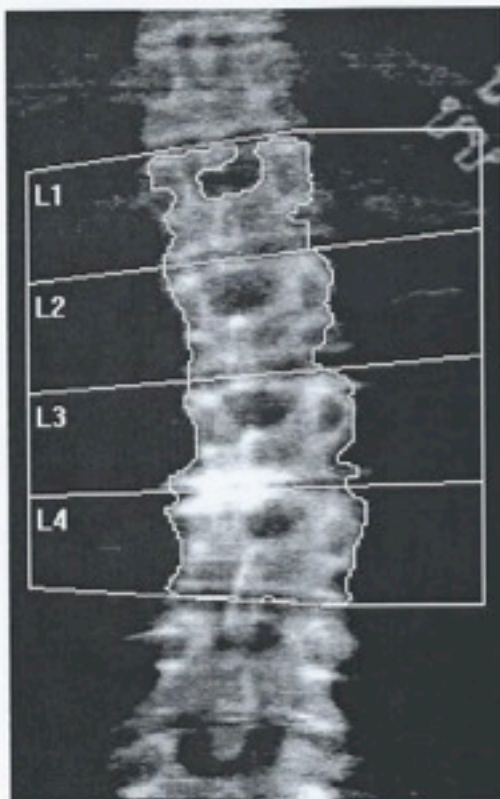
Region	Area (cm <sup>2</sup> )	BMC (g)	BMD (g/cm <sup>2</sup> )	T-score	PR (%)	Z-score	AM (%)
L1	9.54	5.57	0.583	-3.1	63	-2.1	71
L2	11.23	7.71	0.687	-3.1	67	-2.0	76
L3	12.59	11.61	0.923	-1.5	85	-0.3	96
L4	12.77	11.45	0.897	-2.0	80	-0.8	91
<b>Total</b>	<b>46.12</b>	<b>36.34</b>	<b>0.788</b>	<b>-2.4</b>	<b>75</b>	<b>-1.2</b>	<b>85</b>

Total BMD CV 1.0%

WHO Classification: Osteopenia

Fracture Risk: Increased

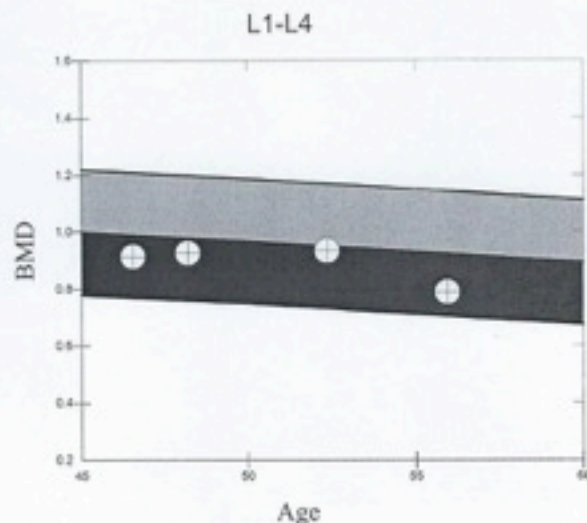
**Physician's Comment:**



116 x 121

### Scan Information:

Scan Date: 11 December 2014 ID: A12111404  
 Scan Type: f Lumbar Spine  
 Analysis: 12 December 2014 20:06 Version 12.6  
 Lumbar Spine  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

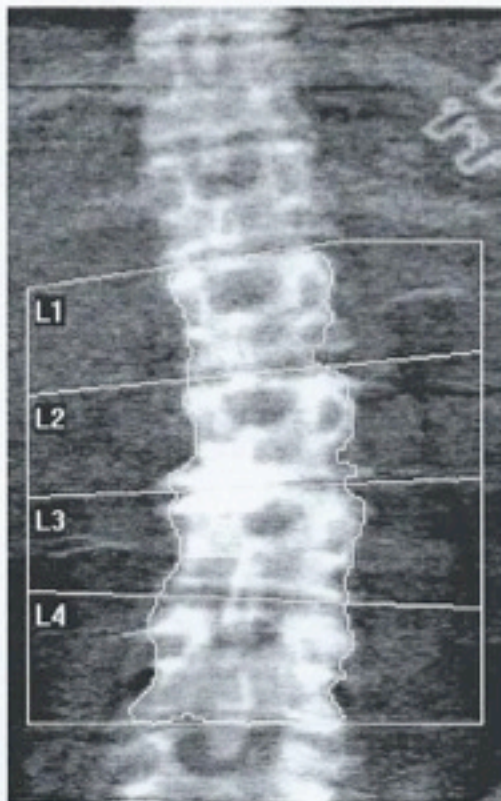


### DXA Results Summary: L1-L4

T-score vs. White Female; Z-score vs. White Female. Source: Hologic

Scan Date	Age	BMD (g/cm <sup>3</sup> )	T-score	BMD Change vs Baseline	BMD Change vs Previous
11.12.2014	55	0.788	-2.4	-13.8%*	-15.6%*
19.05.2011	52	0.934	-1.0	2.1%	0.8%
22.03.2007	48	0.927	-1.1	1.3%	1.3%
25.07.2005	46	0.915	-1.2		

\* Denotes significance at 95% confidence level, LSC is 0.008060 g/cm<sup>2</sup>



116 x 123

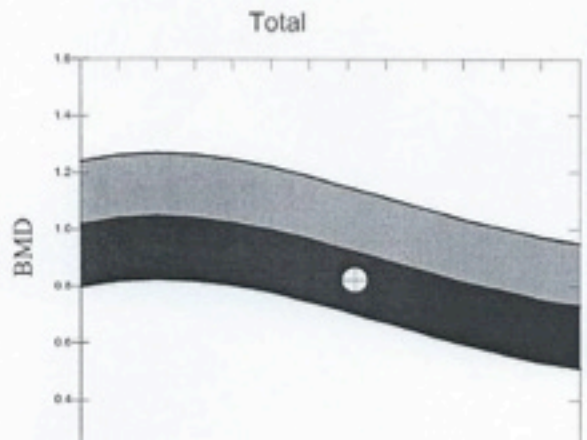
**Scan Information:**

Scan Date: 11 December 2014 ID: A12111404  
 Scan Type: f Lumbar Spine  
 Analysis: 12 December 2014 20:00 Version 12.6  
 Lumbar Spine  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

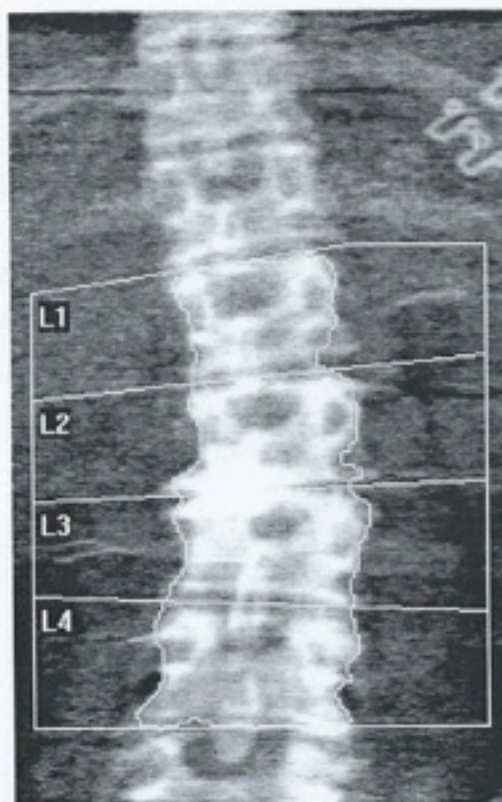
**DXA Results Summary:**

Region	Area (cm <sup>2</sup> )	BMC (g)	BMD (g/cm <sup>2</sup> )	T-score	PR (%)	Z-score	AM (%)
L1	10.95	7.42	0.677	-2.3	73	-1.3	83
L2	12.17	10.95	0.900	-1.2	88	-0.1	99
L3	13.47	12.24	0.908	-1.6	84	-0.4	95
L4	15.41	12.19	0.791	-3.0	71	-1.8	80
<b>Total</b>	<b>52.00</b>	<b>42.79</b>	<b>0.823</b>	<b>-2.0</b>	<b>79</b>	<b>-0.9</b>	<b>89</b>

Total BMD CV 1.0%  
 WHO Classification: Osteopenia  
 Fracture Risk: Increased



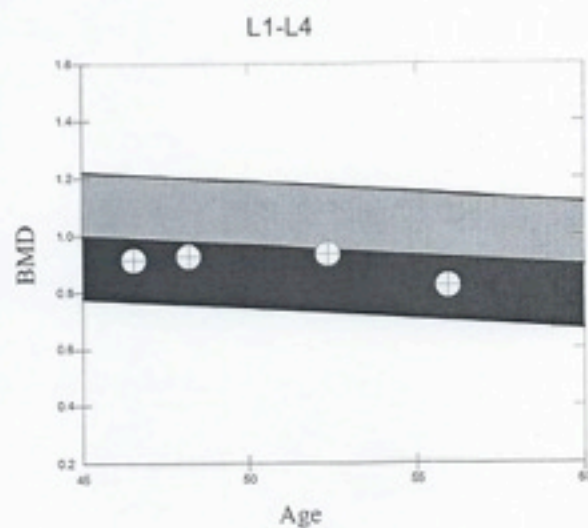
**Physician's Comment:**



116 x 123

**Scan Information:**

Scan Date: 11 December 2014 ID: A12111404  
 Scan Type: f Lumbar Spine  
 Analysis: 12 December 2014 20:00 Version 12.6  
 Lumbar Spine  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

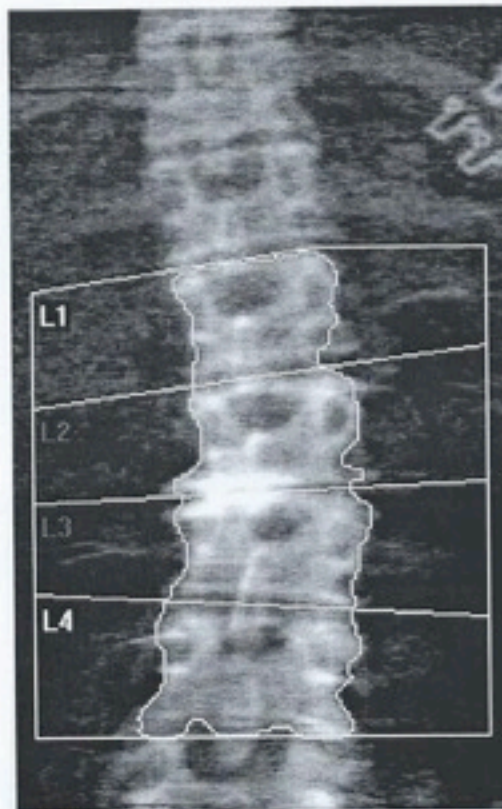
**DXA Results Summary: L1-L4**

T-score vs. White Female; Z-score vs. White Female. Source:Hologic

Scan Date	Age	BMD (g/cm <sup>2</sup> )	T - score	BMD Change vs Baseline	BMD Change vs Previous
11.12.2014	55	0.823	-2.0	-10.0%*	-11.9%*
19.05.2011	52	0.934	-1.0	2.1%	0.8%
22.03.2007	48	0.927	-1.1	1.3%	1.3%
25.07.2005	46	0.915	-1.2		

\* Denotes significance at 95% confidence level, LSC is 0.008060 g/cm<sup>2</sup>





116 x 124

**Scan Information:**

Scan Date: 11 December 2014 ID: A12111404  
 Scan Type: f Lumbar Spine  
 Analysis: 12 December 2014 19:53 Version 12.6  
 Lumbar Spine  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

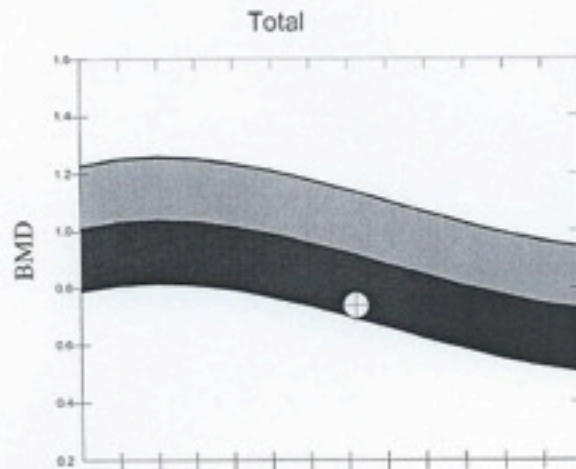
**DXA Results Summary:**

Region	Area (cm <sup>2</sup> )	BMC (g)	BMD (g/cm <sup>2</sup> )	T - score	PR (%)	Z - score	AM (%)
L1	11.01	7.42	0.674	-2.3	73	-1.3	83
L4	16.29	12.71	0.780	-3.1	70	-1.9	79
<b>Total</b>	<b>27.30</b>	<b>20.14</b>	<b>0.738</b>	<b>-2.7</b>	<b>71</b>	<b>-1.6</b>	<b>81</b>

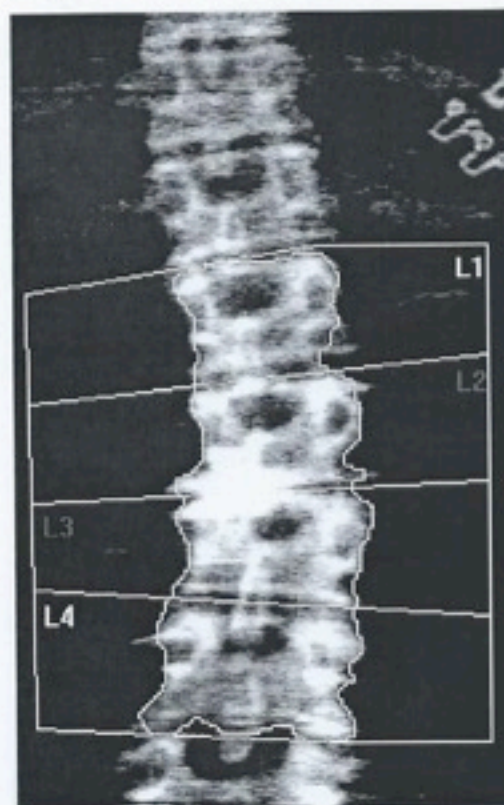
Total BMD CV 1.0%

WHO Classification: Osteoporosis

Fracture Risk: High



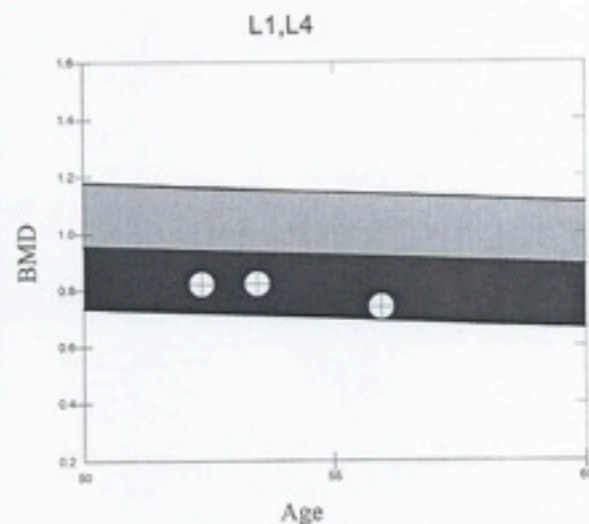
**Physician's Comment:**



118 x 127

**Scan Information:**

Scan Date: 11 December 2014 ID: A12111404  
 Scan Type: f Lumbar Spine  
 Analysis: 11 December 2014 14:49 Version 12.6  
 Lumbar Spine  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

**DXA Results Summary: L1,L4**

T-score vs. White Female; Z-score vs. White Female. Source: Hologic

Scan Date	Age	BMD (g/cm <sup>3</sup> )	T - score	BMD Change vs Baseline	BMD Change vs Previous
11.12.2014	55	0.739	-2.7	-10.1%*	-10.2%*
25.06.2012	53	0.822	-2.0	0.1%	0.1%
19.05.2011	52	0.821	-2.0		

\* Denotes significance at 95% confidence level, LSC is 0.008060 g/cm<sup>2</sup>  
 Rate of change results reflect vertebral levels common to all scans.



97 x 94  
NECK: -49 x 15

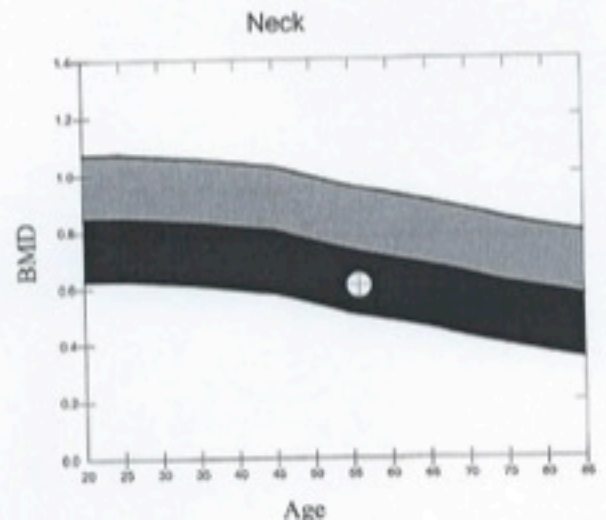
**Scan information:**

Scan Date: 11 December 2014 ID: A12111405  
 Scan Type: f Left Hip  
 Analysis: 11 December 2014 14:04 Version 12.6  
 Left Hip  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

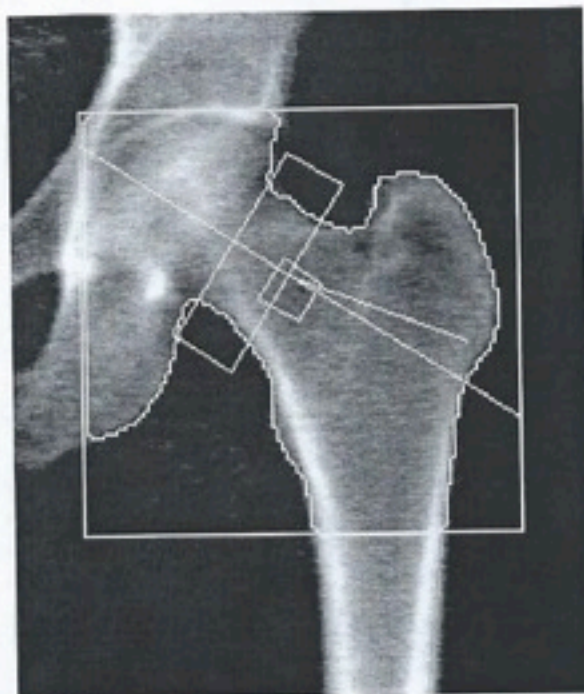
**DXA Results Summary:**

Region	Area (cm <sup>2</sup> )	BMC (g)	BMD (g/cm <sup>2</sup> )	T-score	PR (%)	Z-score	AM (%)
Neck	4.88	2.97	0.607	-2.2	72	-1.1	84
Troch	10.59	5.31	0.501	-2.0	71	-1.3	79
Inter	17.19	14.51	0.844	-1.7	77	-1.2	82
Total	32.66	22.78	0.698	-2.0	74	-1.3	82
Ward's	1.17	0.52	0.440	-2.5	60	-0.8	83

Total BMD CV 1.0%  
 WHO Classification: Osteopenia  
 Fracture Risk: Increased



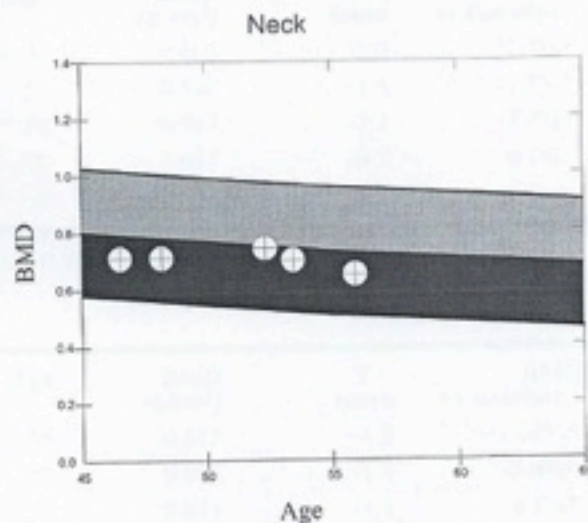
**Physician's Comment:**



97 x 94  
NECK: -49 x 15

**Scan Information:**

Scan Date: 11 December 2014 ID: A12111405  
 Scan Type: f Left Hip  
 Analysis: 11 December 2014 14:38 Version 12.6  
 Left Hip  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

**DXA Results Summary:**

T-score vs. White Female; Z-score vs. White Female. Source: NHANES

Scan Date	Age	BMD (g/cm <sup>2</sup> )	T - score	BMD Change vs Baseline	BMD Change vs Previous
11.12.2014	55	0.650	-1.8	-8.6%*	-7.4%*
25.06.2012	53	0.701	-1.3	-1.4%	-5.7%*
19.05.2011	52	0.744	-0.9	4.7%*	4.7%*
22.03.2007	48	0.711	-1.2	0.0%	0.0%
25.07.2005	46	0.711	-1.2		

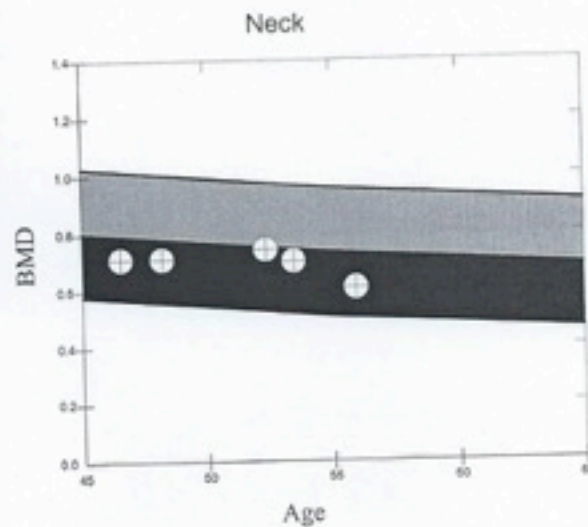
\* Denotes significance at 95% confidence level. LSC is 0.010400 g/cm<sup>2</sup>



97 x 94  
NECK: -49 x 15

**Scan Information:**

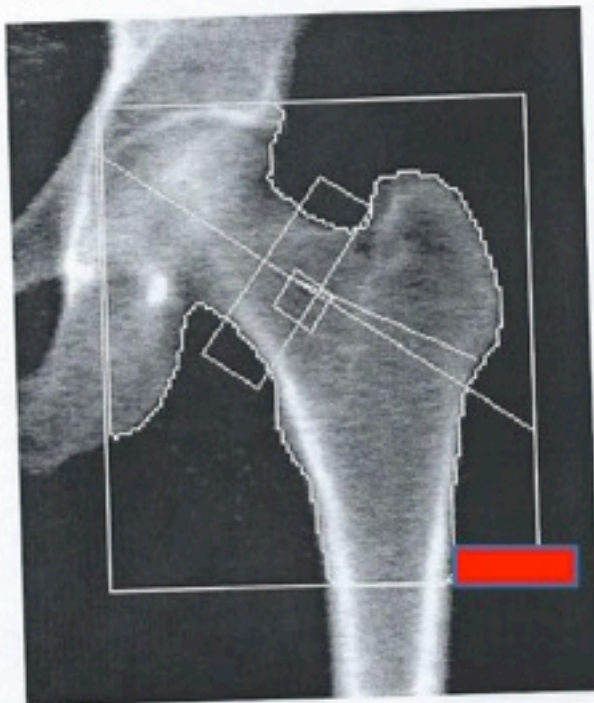
Scan Date: 11 December 2014 ID: A12111405  
 Scan Type: f Left Hip  
 Analysis: 11 December 2014 14:04 Version 12.6  
 Left Hip  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:



**DXA Results Summary:**

T-score vs. White Female; Z-score vs. White Female. Source: NHANES

Scan Date	Age	BMD (g/cm <sup>3</sup> )	T-score	BMD Change vs Baseline	BMD Change vs Previous
11.12.2014	55	0.607	-2.2	-14.6%*	-13.4%*
25.06.2012	53	0.701	-1.3	-1.4%	-5.7%*
19.05.2011	52	0.744	-0.9	4.7%*	4.7%*
22.03.2007	48	0.711	-1.2	0.0%	0.0%
25.07.2005	46	0.711	-1.2		



95 x 107  
NECK: -48 x 15

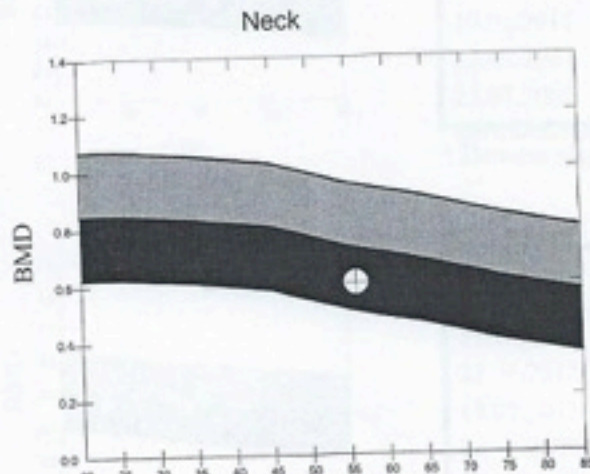
**Scan Information:**

Scan Date: 11 December 2014 ID: A12111405  
 Scan Type: f Left Hip  
 Analysis: 11 December 2014 14:22 Version 12.6  
 Left Hip  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

**DXA Results Summary:**

Region	Area (cm <sup>2</sup> )	BMC (g)	BMD (g/cm <sup>2</sup> )	T-score	PR (%)	Z-score	AM (%)
Neck	4.69	2.84	0.604	-2.2	71	-1.1	83
Troch	11.29	5.68	0.503	-2.0	72	-1.3	80
Inter	19.81	17.73	0.895	-1.3	81	-0.8	87
Total	35.79	26.25	0.733	-1.7	78	-1.0	86
Ward's	1.09	0.46	0.422	-2.7	58	-0.9	80

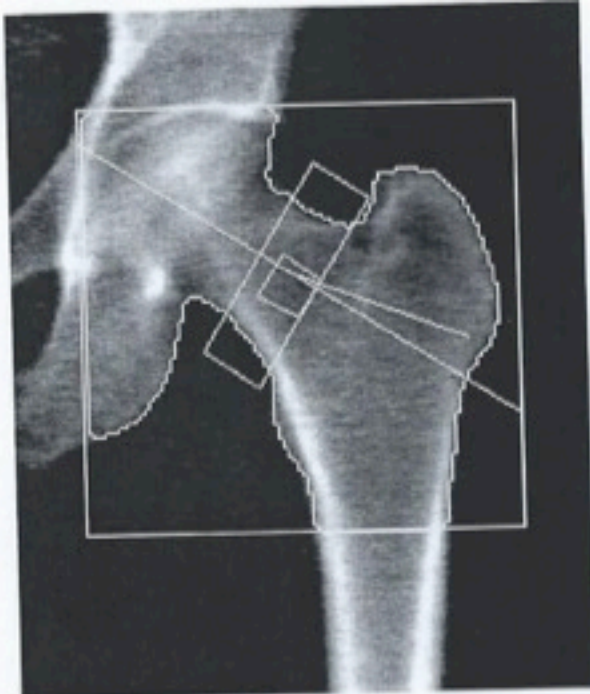
Total BMD CV 1.09%  
 WHO Classification: Osteopenia  
 Fracture Risk: Increased



**Physician's Comment:**

**Scan information:**

Scan Date: 11 December 2014 ID: A12111405  
 Scan Type: f Left Hip  
 Analysis: 11 December 2014 14:04 Version 12.6  
 Left Hip  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

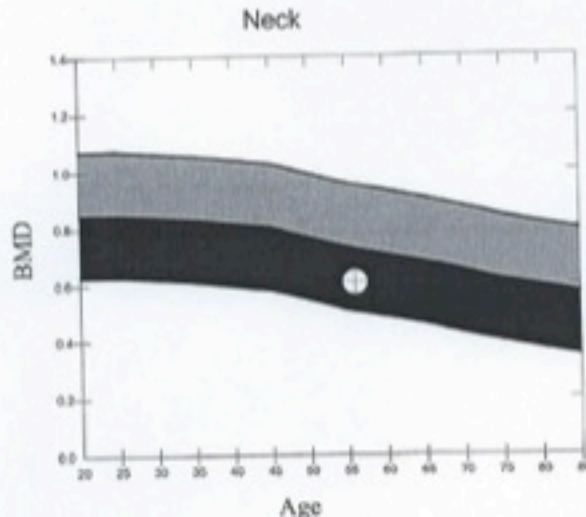


97 x 94  
 NECK: -49 x 15

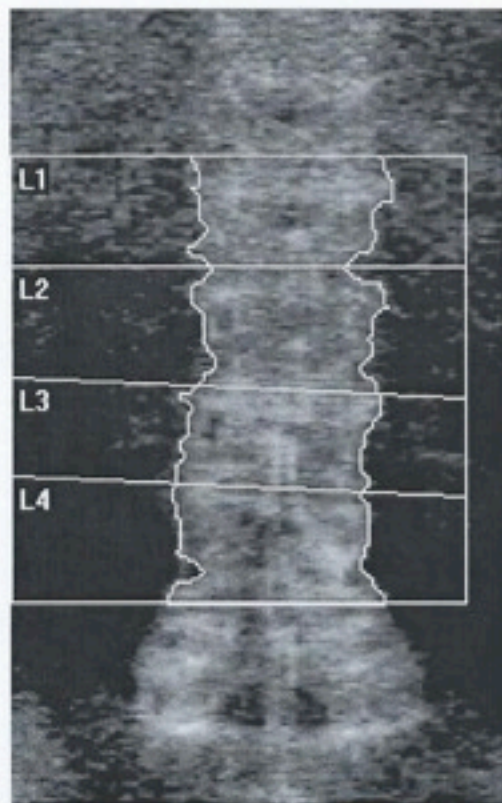
**DXA Results Summary:**

Region	Area (cm <sup>2</sup> )	BMC (g)	BMD (g/cm <sup>2</sup> )	T-score	PR (%)	Z-score	AM (%)
Neck	4.88	2.97	0.607	-2.2	72	-1.1	84
Troch	10.59	5.31	0.501	-2.0	71	-1.3	79
Inter	17.19	14.51	0.844	-1.7	77	-1.2	82
Total	32.66	22.78	0.698	-2.0	74	-1.3	82
Ward's	1.17	0.52	0.440	-2.5	60	-0.8	83

Total BMD CV 1.0%  
 WHO Classification: Osteopenia  
 Fracture Risk: Increased



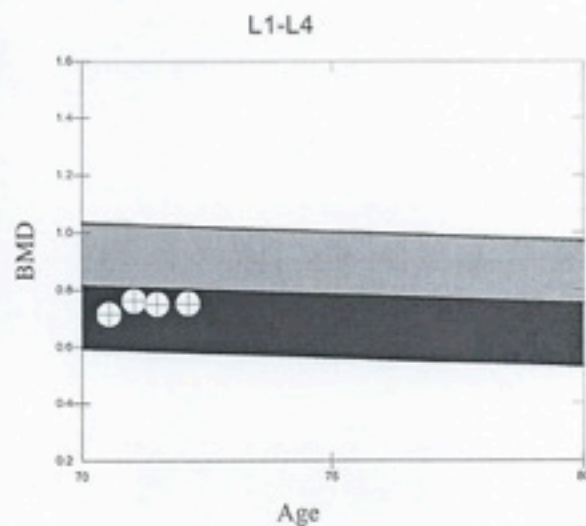
Physician's Comment:



116 x 114

**Scan Information:**

Scan Date: 27 November 2006 ID: A11270608  
 Scan Type: f Lumbar Spine  
 Analysis: 27 November 2006 11:52 Version 12.2  
 Lumbar Spine (auto low density)  
 Operator: VC  
 Model: QDR 4500C (S/N 47923)  
 Comment:

**DXA Results Summary: L1-L4**

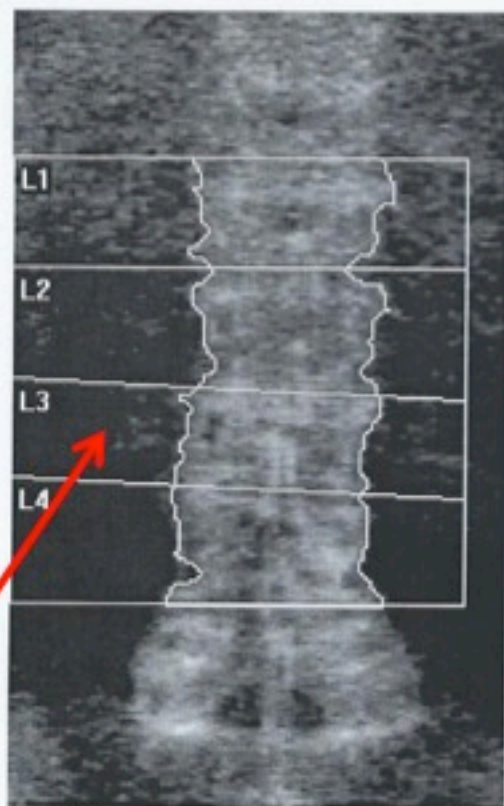
T-score vs. White Female; Z-score vs. White Female. Source:Hologic

Scan Date	Age	BMD (g/cm <sup>2</sup> )	T - score	BMD Change vs Baseline	BMD Change vs Previous
27.11.2006	72	0.753	-2.7	5.2%*	0.4%
14.04.2006	71	0.750	-2.7	4.8%*	-1.5%
28.10.2005	71	0.762	-2.6	6.5%*	6.5%*
27.04.2005	70	0.716	-3.0		

\* Denotes significance at 95% confidence level, LSC is 0.008060 g/cm<sup>2</sup>



Referring Physician: CAMOZZI\*\*PTH\*\*



116 x 114

**Scan Information:**

Scan Date: 27 November 2006 ID: A11270608

Scan Type: f Lumbar Spine

Analysis: 27 November 2006 11:52 Version 12.2

Lumbar Spine (auto low density)

Operator: VC

Model: QDR 4500C (S/N 47923)

Comment:

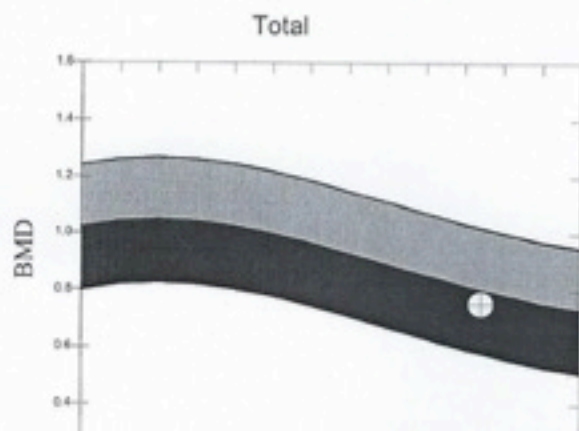
**DXA Results Summary:**

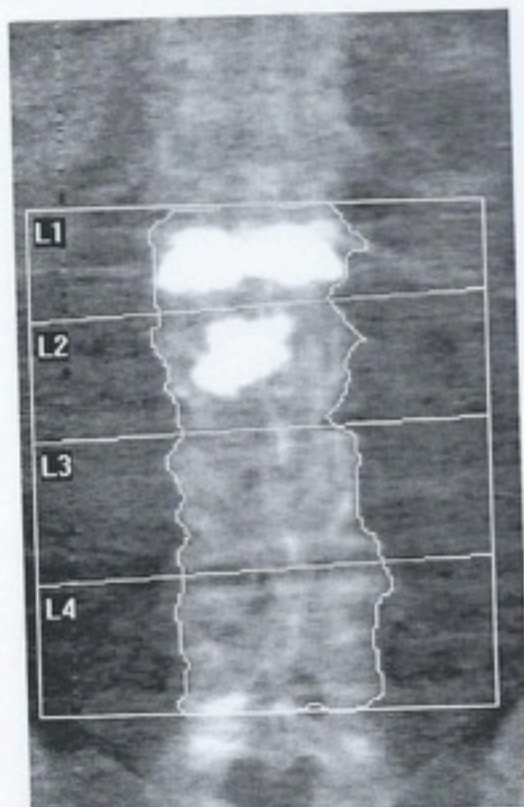
Region	Area (cm <sup>2</sup> )	BMC (g)	BMD (g/cm <sup>2</sup> )	T-score	PR (%)	Z-score	AM (%)
L1	13.21	7.59	0.574	-3.2	62	-1.2	81
L2	13.96	9.65	0.691	-3.1	67	-0.9	88
L3	12.16	10.69	0.879	-1.9	81	0.5	106
L4	14.76	12.82	0.869	-2.2	78	0.1	102
<b>Total</b>	<b>54.09</b>	<b>40.75</b>	<b>0.753</b>	<b>-2.7</b>	<b>72</b>	<b>-0.4</b>	<b>94</b>

Total BMD CV 1.0%

WHO Classification: Osteoporosis

Fracture Risk: High

**Physician's Comment:**



116 x 129

**Scan Information:**

Scan Date: 23 June 2014 ID: A06231405  
 Scan Type: f Lumbar Spine  
 Analysis: 12 December 2014 20:15 Version 12.6  
 Lumbar Spine  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

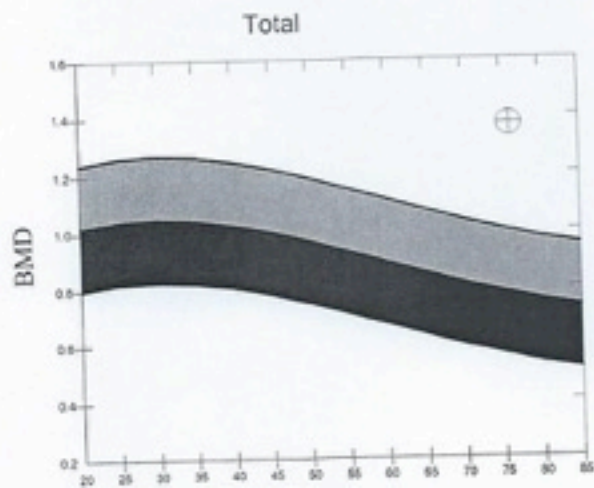
**DXA Results Summary:**

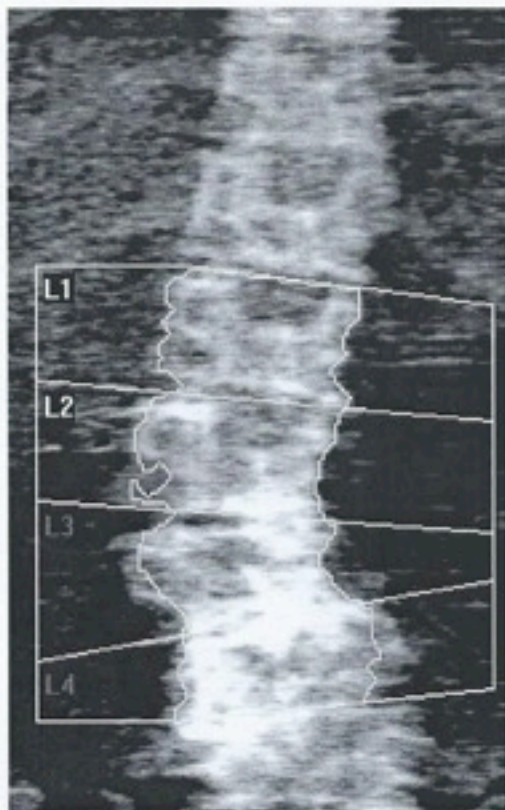
Region	Area (cm <sup>2</sup> )	BMC (g)	BMD (g/cm <sup>2</sup> )	T-score	PR (%)	Z-score	AM (%)
L1	12.87	30.94	2.404	13.4	260	15.6	351
L2	14.26	23.29	1.633	5.5	159	7.9	215
L3	16.82	14.10	0.838	-2.2	77	0.3	105
L4	18.30	16.87	0.922	-1.8	83	0.9	112
<b>Total</b>	<b>62.25</b>	<b>85.19</b>	<b>1.369</b>	<b>2.9</b>	<b>131</b>	<b>5.4</b>	<b>176</b>

Total BMD CV 1.0%

WHO Classification: Normal

Fracture Risk: Not Increased

**Physician's Comment:**



116 x 115

**Scan Information:**

Scan Date: 10 September 2014 ID: A0910140J  
 Scan Type: f Lumbar Spine  
 Analysis: 12 December 2014 20:13 Version 12.6  
 Lumbar Spine (auto low density)  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

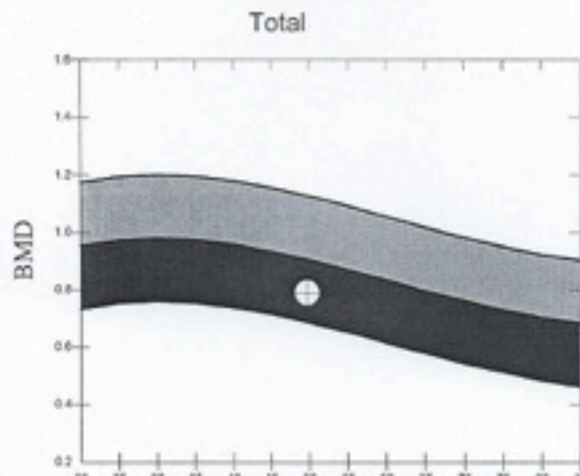
**DXA Results Summary:**

Region	Area (cm <sup>2</sup> )	BMC (g)	BMD (g/cm <sup>2</sup> )	T-score	PR (%)	Z-score	AM (%)
L1	14.50	9.50	0.655	-2.5	71	-1.8	76
L2	13.48	12.59	0.934	-0.9	91	-0.2	98
<b>Total</b>	<b>27.98</b>	<b>22.09</b>	<b>0.789</b>	<b>-1.7</b>	<b>81</b>	<b>-1.1</b>	<b>87</b>

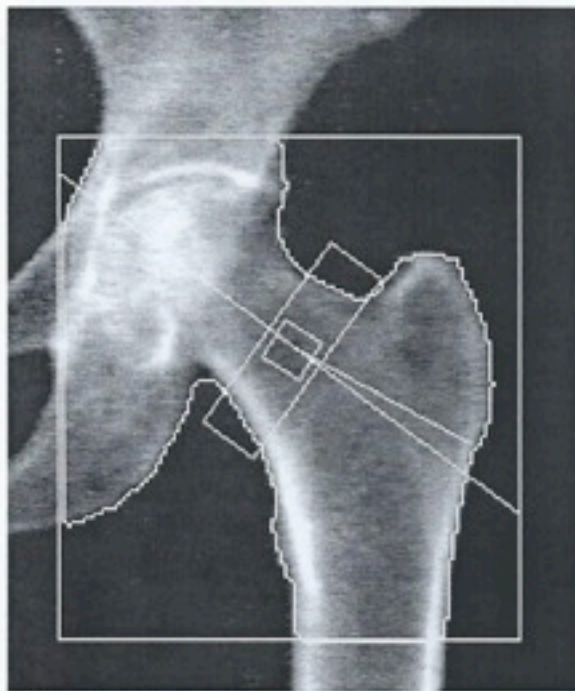
Total BMD CV 1.0%

WHO Classification: Osteopenia

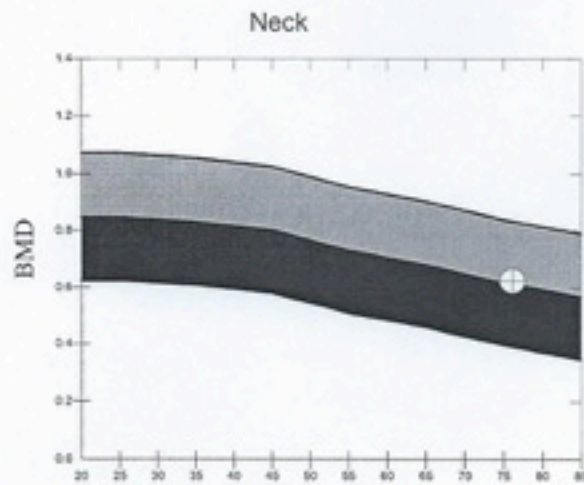
Fracture Risk: Increased



**Physician's Comment:**



102 x 111  
NECK: -49 x 15



### Scan Information:

Scan Date: 23 June 2014 ID: A06231406  
 Scan Type: f Left Hip  
 Analysis: 23 June 2014 11:01 Version 12.6  
 Left Hip  
 Operator: WG  
 Model: Discovery W (S/N 70105)  
 Comment:

### DXA Results Summary:

Region	Area (cm <sup>2</sup> )	BMC (g)	BMD (g/cm <sup>3</sup> )	T-score	PR (%)	Z-score	AM (%)
Neck	5.06	3.16	0.625	-2.0	74	0.1	102
Troch	10.83	6.12	0.565	-1.4	80	0.2	104
Inter	19.67	16.78	0.853	-1.6	78	0.0	100
Total	35.55	26.06	0.733	-1.7	78	0.1	102
Ward's	1.04	0.34	0.329	-3.5	45	-0.6	83

Total BMD CV 1.0%

WHO Classification: Osteopenia

Fracture Risk: Increased

Physician's Comment:

## ISCD (International Society of Clinical Densitometry): Official Positions

- Use all evaluable vertebrae and **only exclude vertebrae that are affected by local structural change or artifact**. Use three vertebrae if four cannot be used and two if three cannot be used
- **BMD based diagnostic classification should not be made using a single vertebra**

## BMD Reporting in Postmenopausal Women and in Men Age 50 and Older

- T-scores are preferred.
- The WHO densitometric classification is applicable.

## BMD Reporting in Females Prior to Menopause and in Males Younger Than Age 50

***Z-scores, not T-scores, are preferred***

- **This is particularly important in children**

A Z-score of -2.0 or lower is defined as “below the expected range for age”, and a Z-score above -2.0 is “within the expected range for age.”

- Osteoporosis cannot be diagnosed in men under age 50 on the basis of BMD alone.
- The WHO diagnostic criteria may be applied to women in the menopausal transition.

The minimum acceptable precision for an individual technologist is:

- Lumbar Spine: 1.9% (LSC=5.3%)
- Total Hip: 1.8% (LSC=5.0%)
- Femoral Neck: 2.5% (LSC=6.9%)

# Ultrasonografia ossea al calcagno

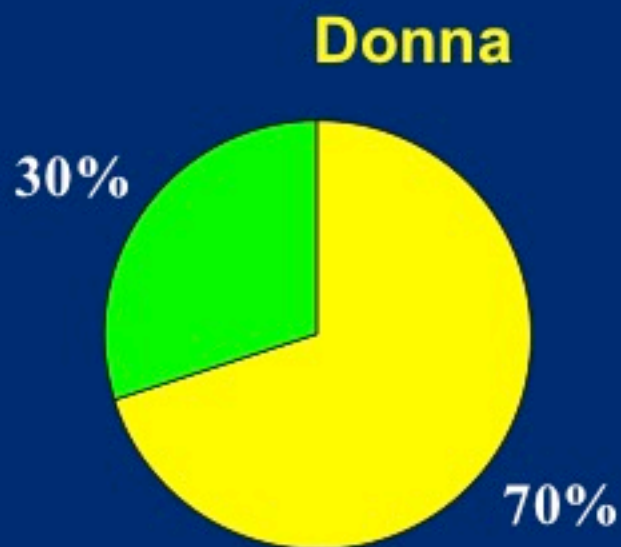




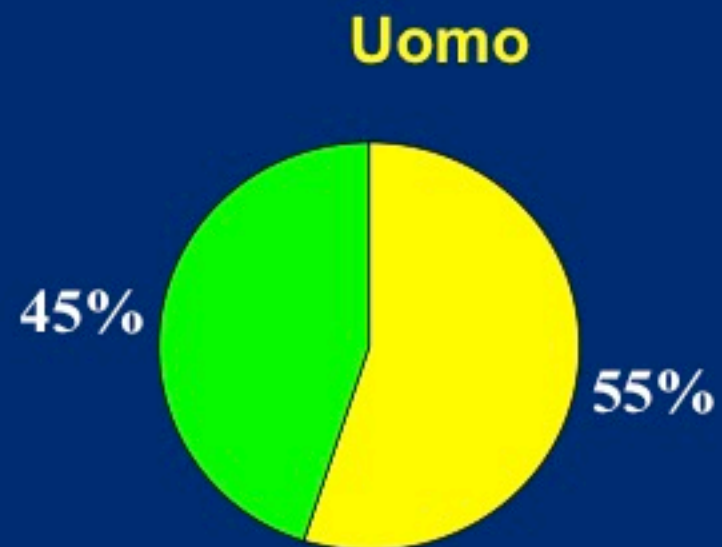
# Diagnostica di laboratorio

- **Escludere forme secondarie**
- Valutare il metabolismo osseo
- Follow-up

# Frequenza delle osteoporosi secondarie per sesso



■ primitive ■ secondarie



■ primitive ■ secondarie

# Cause di Osteoporosi secondaria

## Patologia endocrina

- Iperparatiroidismo
- Ipogonadismo
- Cushing
- Iperparatiroidismo
- Diabete

## Neoplasie

- Mieloma
- Malattie linfoproliferative

## Malattie reumatiche

Malattie infiammatorie  
croniche intestinali

Insuff. Renale ed epatica

## Farmaci

- Corticosteroidi
- Anticonvulsivanti
- Abuso di etanolo
- Eparina
- Sovradosaggio di Tiroxina

## Altre cause

- Malassorbimento
- Mastocitosi
- Ipercalciuria idiopatica
- Osteogenesi imperfetta

# Procedure Diagnostiche di Laboratorio

## ESAMI DI LABORATORIO: I° LIVELLO

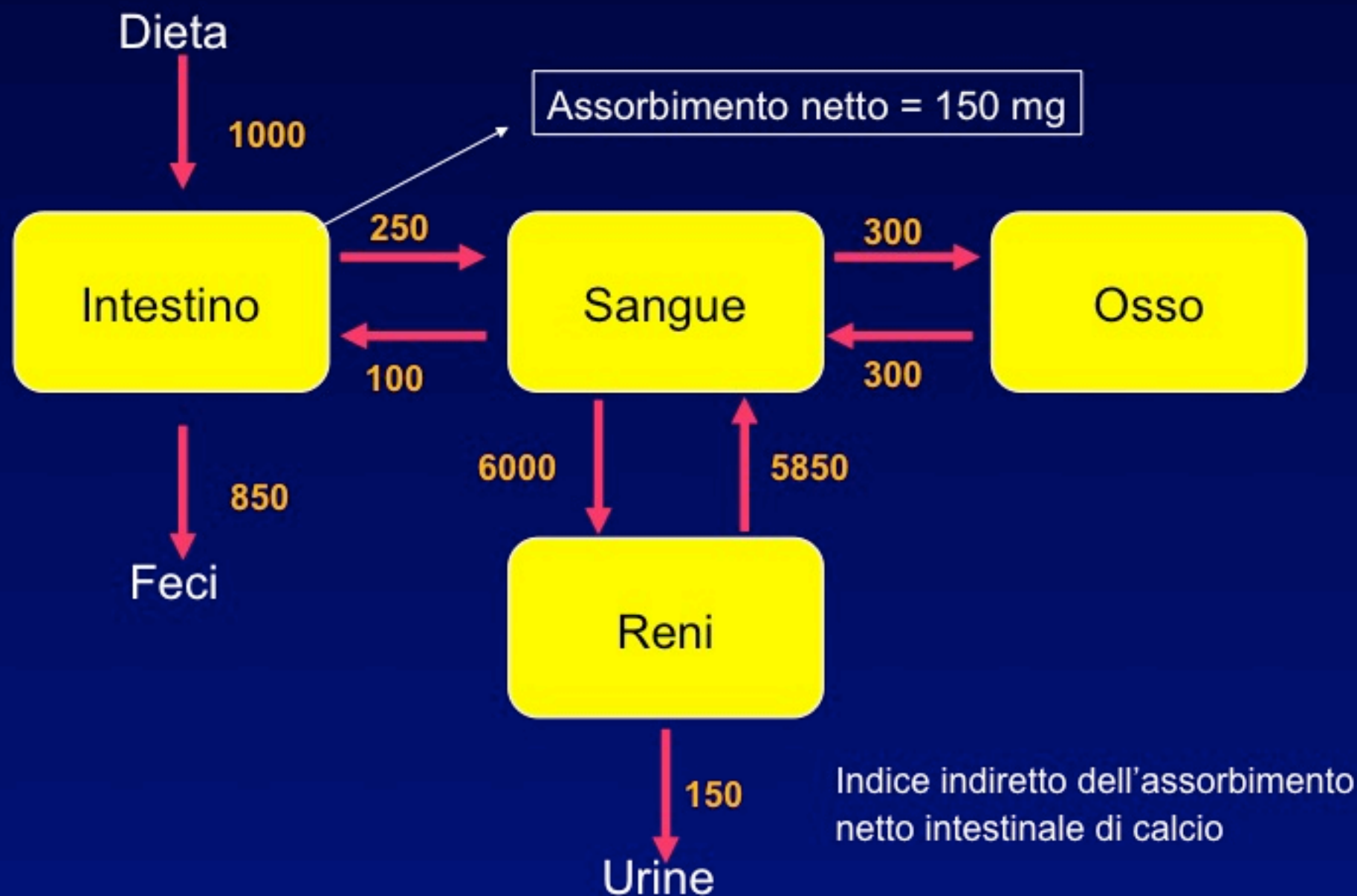
Esclusione forme  
secondarie

- Emocromo completo
- Protidogramma elettroforetico
- Creatininemia
- VES, PCR

Valutazione  
metabolismo

- Calcemia, fosforemia
- Calciuria delle 24 ore
- Vitamina D (25OHD)?

# Calciuria delle 24 ore



## Calciuria delle 24 ore (4 mg/kg)

### ■ Alta

- aumento dell'introito alimentare di Ca
- iperassorbimento intestinale
- ipervitaminosi D
- ipercalciuria renale
- iperparatiroidismo primario

### ■ Bassa

- basso introito alimentare di Ca
- malassorbimento intestinale (celiachia)
- insufficienza renale,
- ipovitaminosi D
- ipercalcemia ipocalciurica familiare benigna (rara)

# Procedure Diagnostiche di Laboratorio

## ESAMI DI LABORATORIO: II° LIVELLO

(approfondire sospetti clinici o spiegare alterazioni degli esami di primo livello)

- PTH
- Anticorpi anti-transglutaminasi
- Immunofissazione proteica urinaria o sierica (mieloma multiplo)
- Ormoni specifici (TSH; Cortisoluria 24h; Testosterone)
- Ago-aspirato midollare (sospetta Neoplasia ematologica)
- Markers neoplastici

# Bone Turnover Markers:

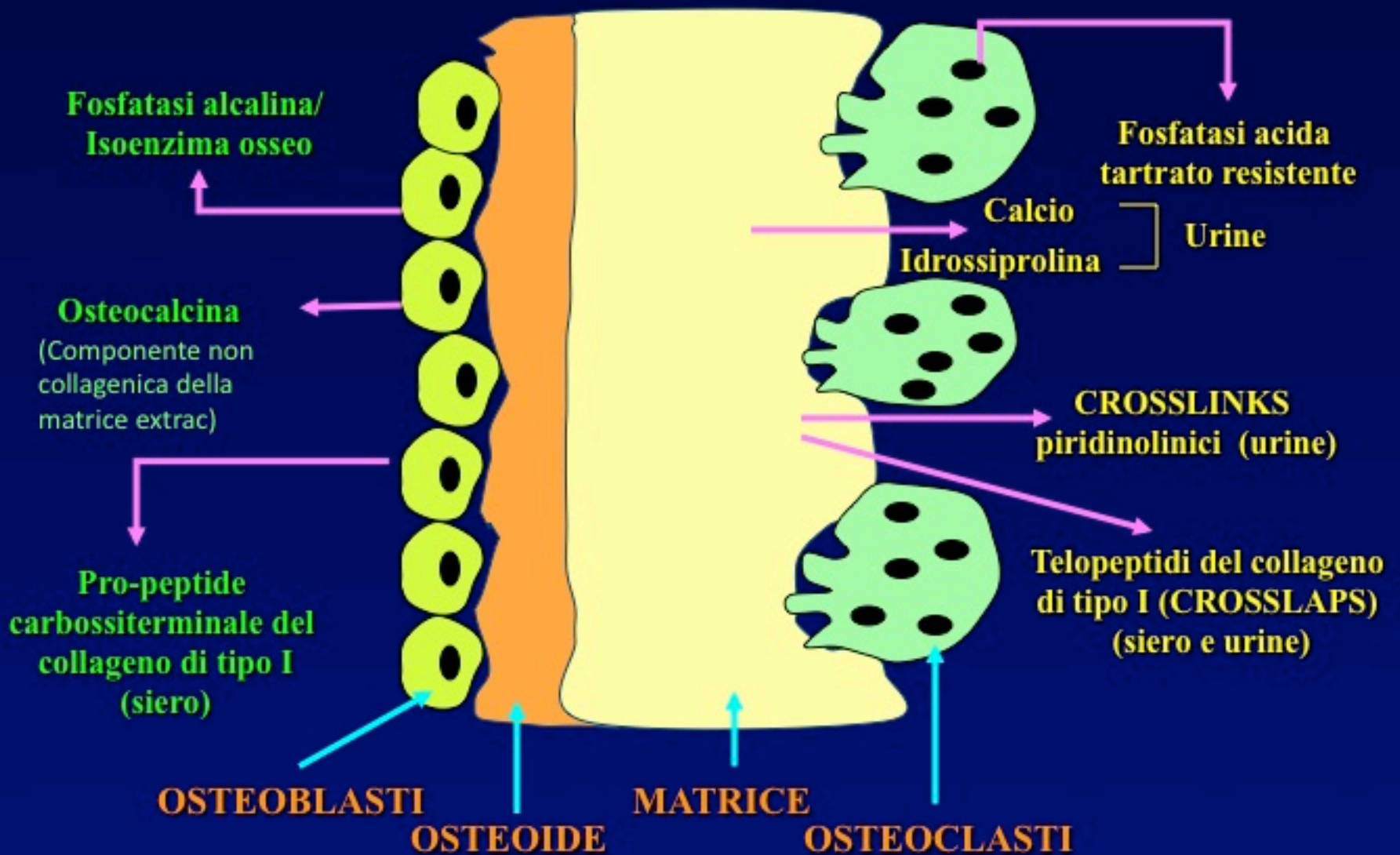
---

- Molecole che direttamente o indirettamente sono correlate all'attività degli osteoclasti e degli osteoblasti
- Non hanno funzione nel controllo del metabolismo scheletrico

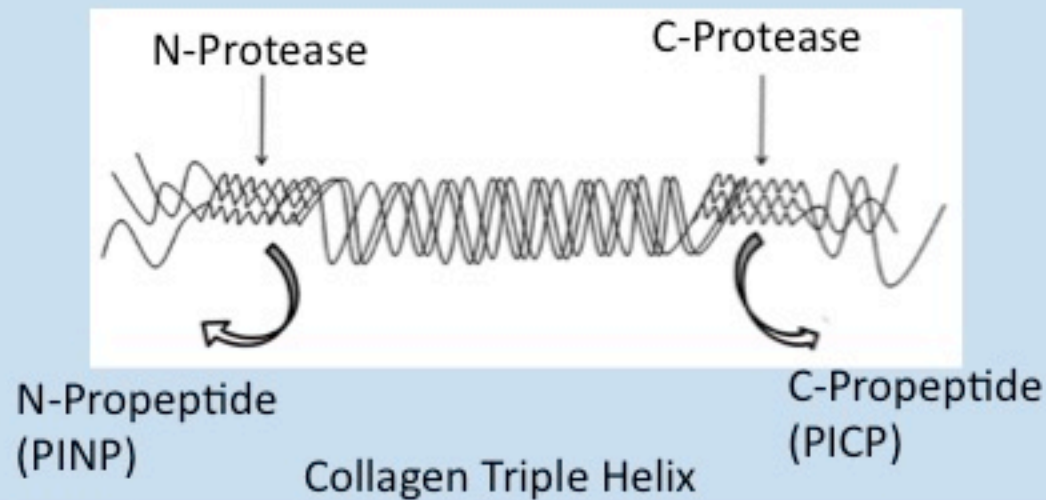


## FORMAZIONE

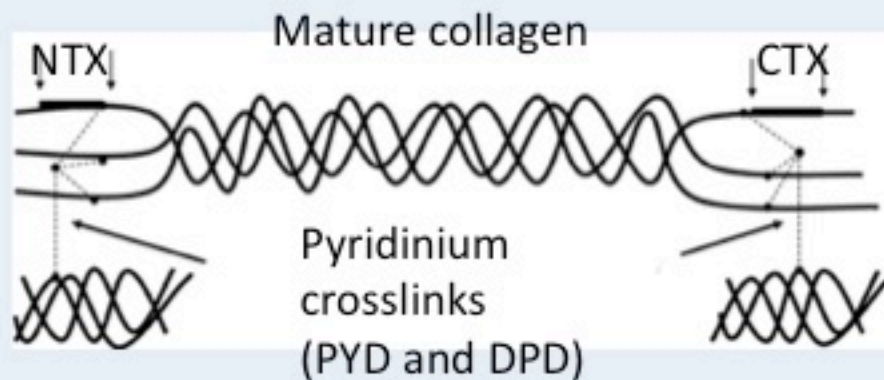
## RIASSORBIMENTO



***The catabolism of procollagen extension peptides by proteases during collagen formation leads to PICP and PINP production***



***The catabolism of mature collagen by osteoblasts produces telopeptides and pyridinium crosslinks.***



## Scegliere un marker

Il significato clinico di ogni marker dipende da due fondamentali caratteristiche

- **Specificità**: capacità di un marker di riflettere variazioni che derivano esclusivamente dalla attività biologica dello scheletro
  - *DPD, ad esempio non è presente nella cute, I telopeptidi N – e C-terminali derivanti dal collagene di tipo I, che è presente anche nella cute sono meno specifici*
  - *ALP ossea è espressione solo di attività osteoblastica*
- **Variabilità**
  - *Analitica (raccolta del campione, metodo)*
  - *Pre-analitica*

## Fonti di variabilità pre-analitica dei markers di rimodellamento osseo

### Fonti non controllabili

- Età
- Stato menopausale
- Sesso
- Fratture
- Gravidanza e allattamento
- Malattie
- Immobilità
- Farmaci



con l'età  
entro pochi mesi dall'inizio della menopausa  
nella donna anziana che nell'uomo anziano  
dopo una frattura ( oltre 52 settimane )  
persiste dopo il parto



ipertiroidismo, insuff renale cronica  
riassorbimento ↓ osteoformazione  
anticonvulsivanti ↓ glucocorticoidi

### Fonti controllabili

- Ritmo circadiano
- Digiuno
- Esercizio fisico
- Fase del ciclo mestruale
- Stagionalità
- Dieta



riassorbimento nella seconda parte delle notte  
s-CTX si riduce del 20% dopo il pasto  
effetto cronico o acuto, dipende dal tipo di sforzo  
riassorbimento ↑ osteoformazione , fase luteale  
durante l'inverno  
subito dopo la supplementazione di calcio

# Utilità clinica

- **Diagnosi differenziale**
- **Valutare la velocità di perdita ossea**
- **Stima del rischio di frattura**
- **Monitorare l'effetto di un trattamento**
- **Valutare la compliance**

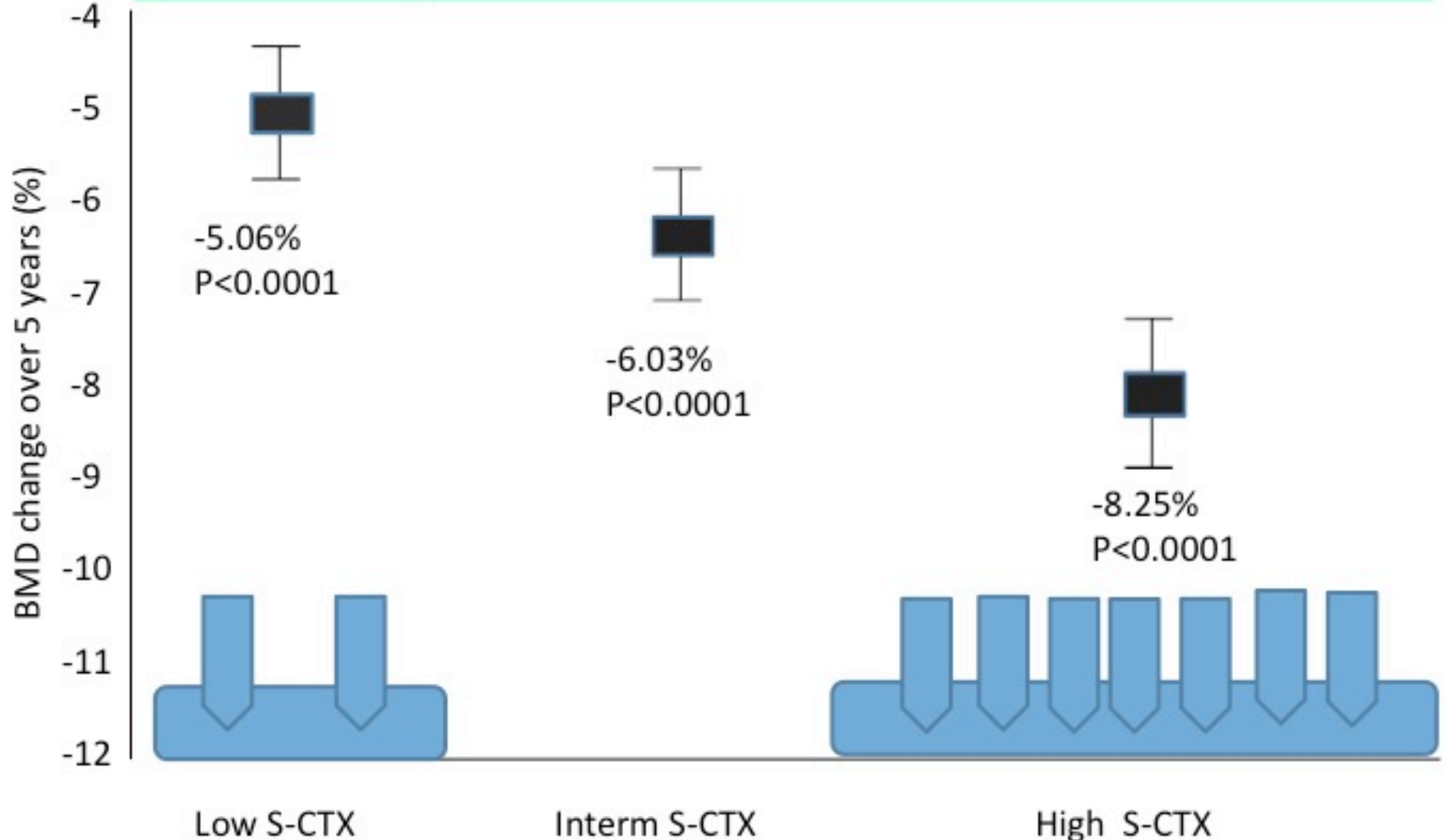
## Increased Levels of Bone Alkaline Phosphatase (BAP)

---

- Increased bone formation
- Hyperparathyroidism
- **Paget's disease**
- High turnover osteoporosis
- Hyperthyroidism
- Renal osteodystrophy
- Fractures
- Acromegaly
- **Osteomalacia and rickets**
- **Bone metastasis ??**

## BTM identifies women with the highest rate of bone loss

Velocità di perdita ossea e marker di riassorbimento



## Correlazione fra aumento del riassorbimento osseo e rischio di frattura

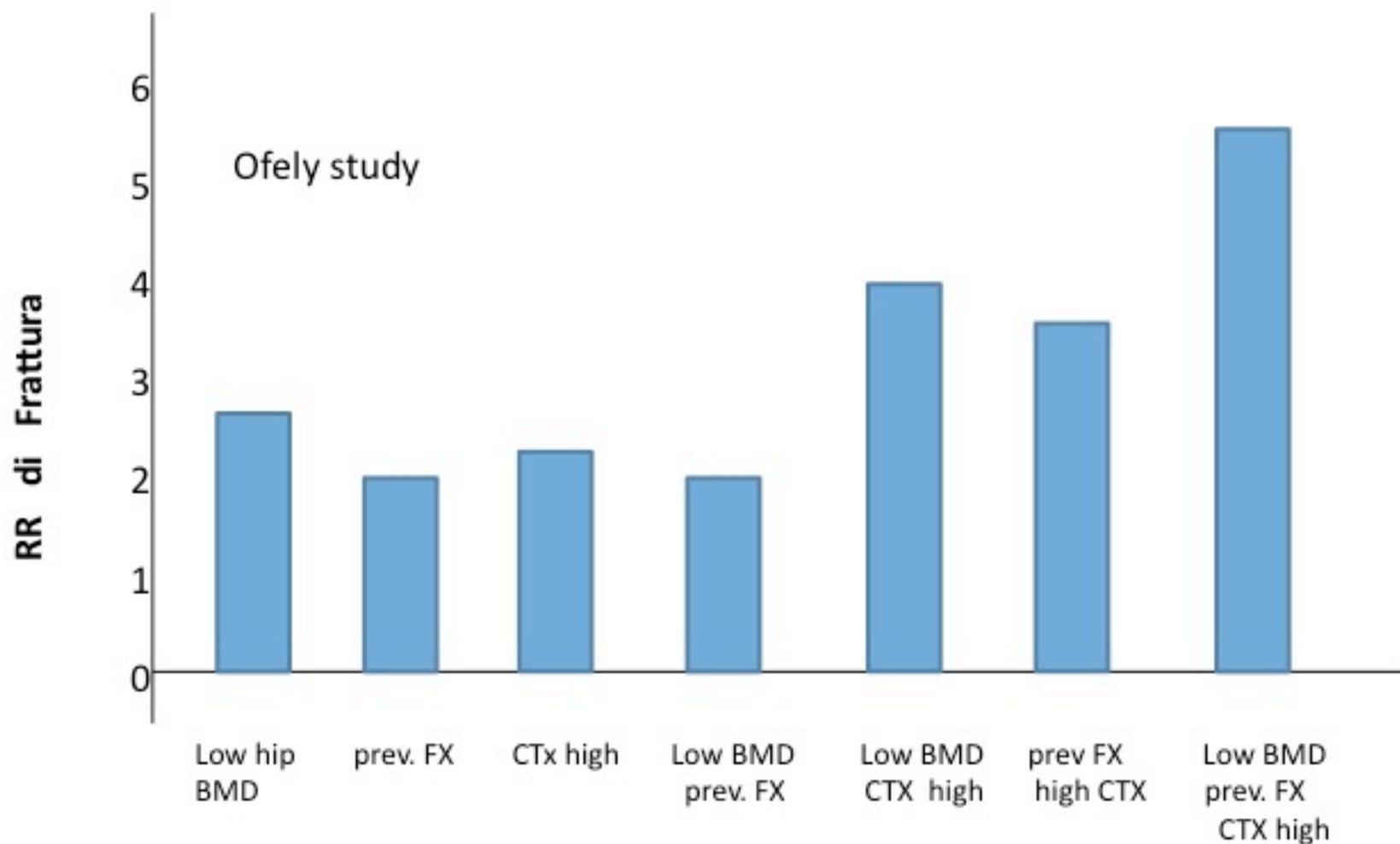
Study	Age (years)	Fx	RR-BMD (95% CI)	Marker	RR-Marker (95%CI)
Epidos	> 75	hip	2.8 (1.6-5.1)	U-CTx F DPD	2.2 (1.3-3.6) 1.9 (1.1-3.2)
Ofely	64 (mean)	all	2.8 (1.4-5.6)	U-CTx S-CTx	2.3 (1.3-4.1) 2.1 (1.1-3.6)
HOS	69 (mean)	all	1.6(1.2-2.2)	U-CTx	1.6 (1.2-2)
Rotterdam	> 75	all	1.3(0.6-2.7)	U-DPD	1.9 ( 1.2-3.8)
Malmö	> 75	all	2.2(1.5-3.1)	TRACP U-Oc	2.2 (1.2-4.2) 2.1(1.1-4.1)

**Età**  
**Tipodi frattura**  
**Marker scelto**

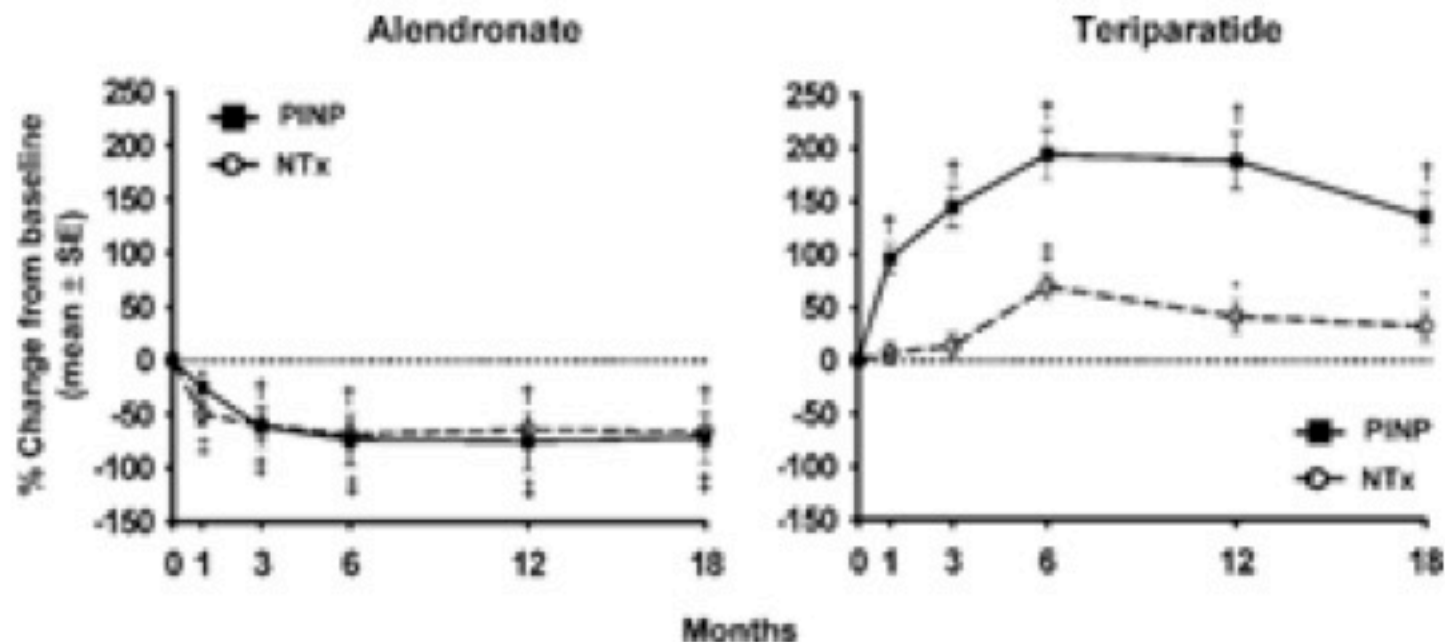
**Terzili o SD?**  
**Metodo?**



## L'associazione di BTM con gli altri fattori di rischio indipendenti migliora la predizione del rischio di frattura

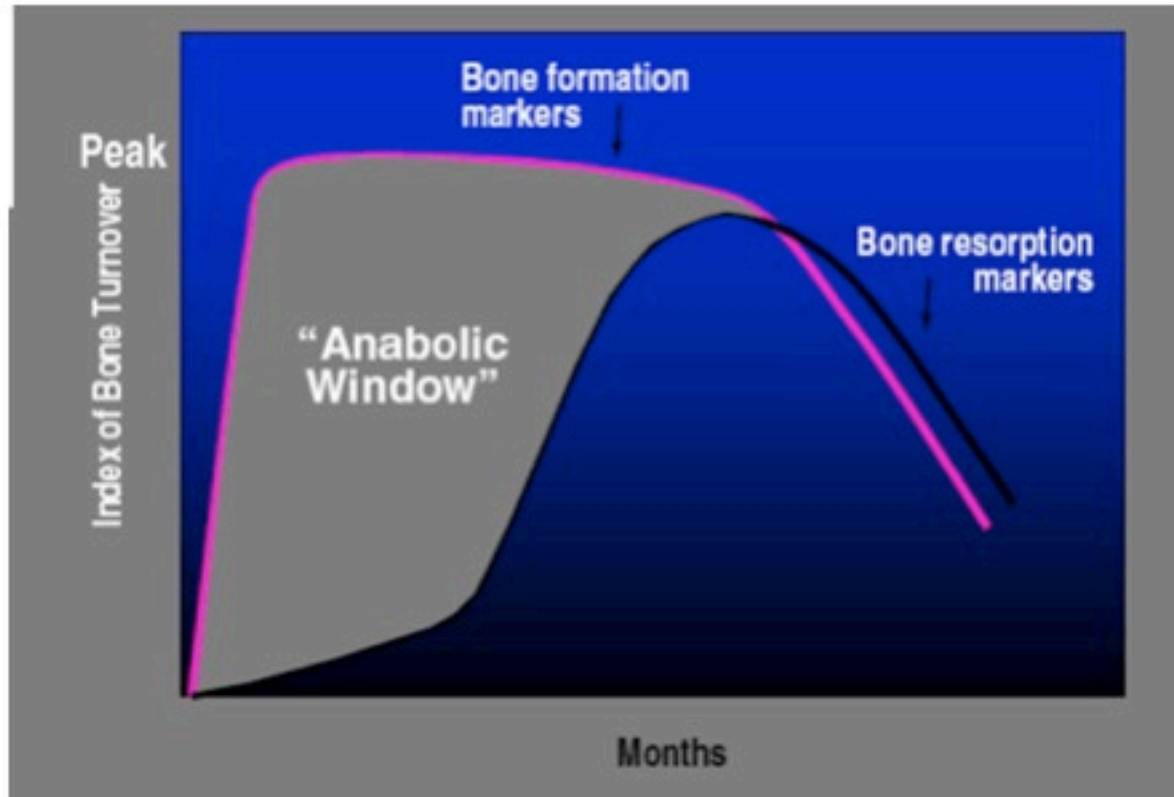


## Differential Effects of Teriparatide and Alendronate on Bone Remodeling in Postmenopausal Women



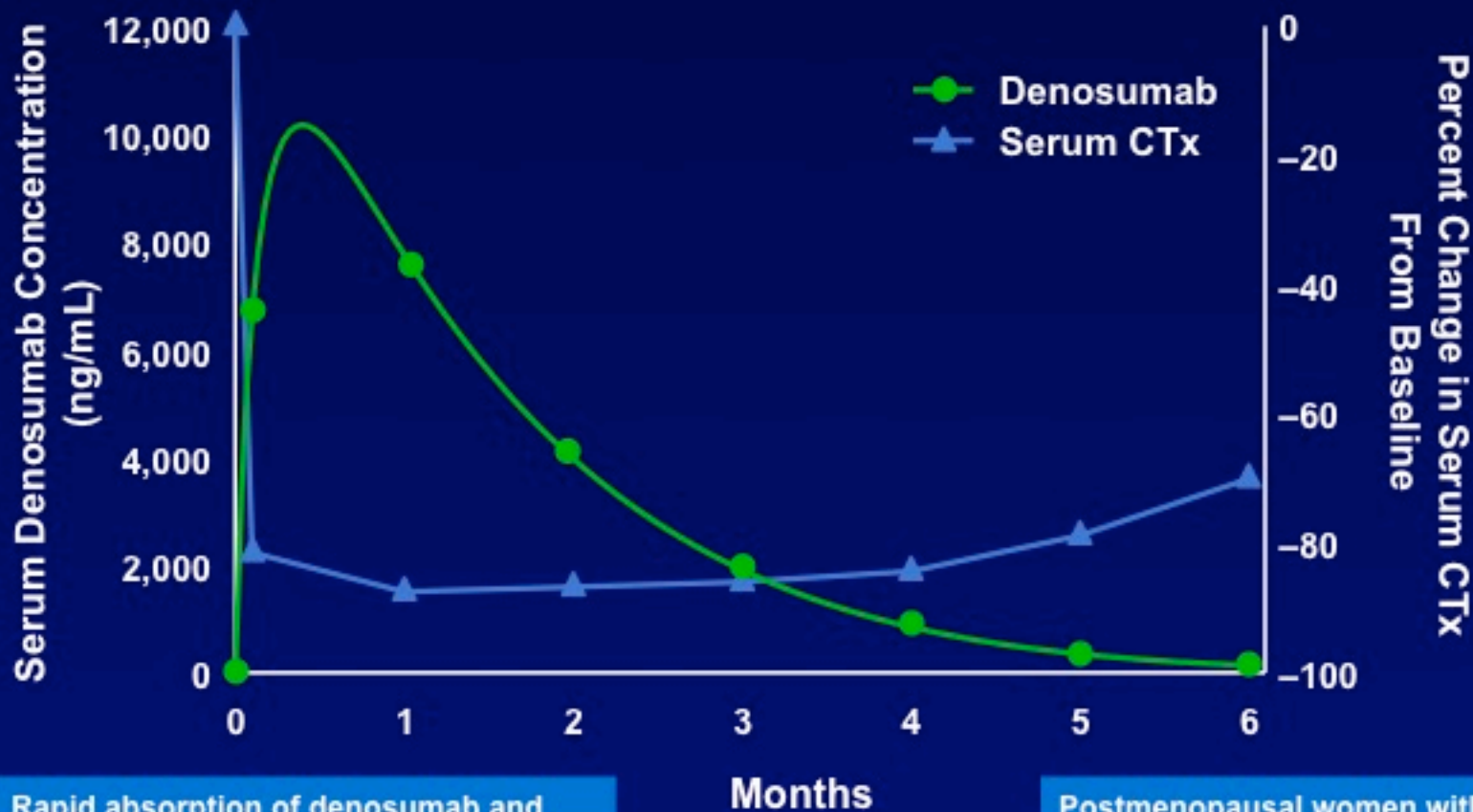
Percent change from baseline in markers of bone formation (PINP; ■) and bone resorption (NTx; ○) in the alendronate (ALN) and teriparatide (TPTD) treatment groups of the biopsy subset.  
\* $p < 0.05$ ; † $p < 0.01$ ; ‡ $p < 0.001$  from baseline.

# Modello cinetico dell'effetto anabolico del PTH



Il marker di scelta sarà un marker di osteoformazione

# Serum Denosumab Concentrations and Percent Change From Baseline for Serum CTx



Rapid absorption of denosumab and suppression of serum CTx (by 3 days)

Months

Postmenopausal women with low BMD (N = 41–47; phase 2 study)