

**The Vertebral Disc
Effect of HRT,
Fracture prevention
and
Osteoporosis**

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Vertebral Osteoporotic Fracture

- Affects 18 – 25 % of postmenopausal women (O. Johnel et al 2002)
- Underdiagnosed condition - insidious onset.
- High mortality and morbidity (Sarkar et al 1999).
- Risk factor for more vertebral and non-vertebral fractures (4 fold increased risk for hip fractures) (Berger et al 1994).

Vertebral Fracture and BMD

- “50% of postmenopausal women with a compression vertebral fracture have osteopaenia rather than osteoporosis”.

Prof. D Agnusdei Regional Forum Meeting on Postmenopausal Health 2003.

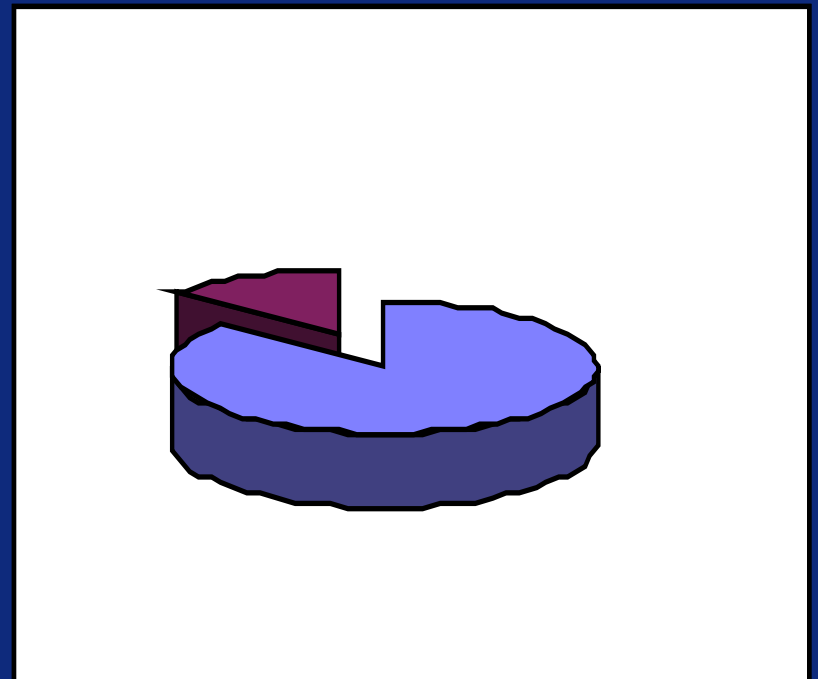
- “We cannot explain why some women with Vertebral T-Scores of -4.0 (severe osteoporosis) and more do NOT fracture while others with better T-Scores sustain fractures”.

Prof J Pfeilschifter European Menopause Meeting 2003.

Vertebral Fracture and BMD

- Vertebral Fracture Risk Reduction
Attributable to Increase in BMD

- Risedronate 7-28%
- Alendronate 16%
- Raloxifene 4%



Vertebral Fracture

- Non Density variables

i.e. Extracellular Matrix



- Extraosseous

Intervertebral Discs –

(Scanty literature re: disc and menopause)

Constituents of intervertebral discs

INTERVERTEBRAL DISCS

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graph TD; A[INTERVERTEBRAL DISCS] --- B[COLLAGEN]; A --- C[ELASTIN]; A --- D[GLYCOAMINOGLYCANS  
80 % WATER CONTENT]
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COLLAGEN

ELASTIN

GLYCOAMINOGLYCANS

80 % WATER CONTENT

Functions of Intervertebral Discs

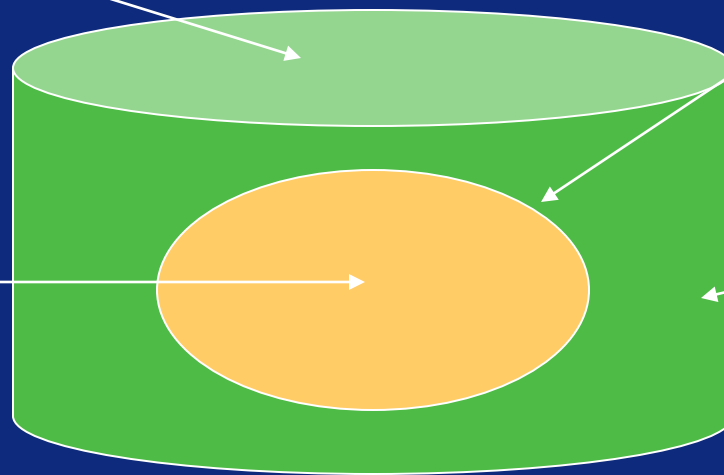
- Intervertebral Discs are responsible for 20% of the spinal column height.
- Allow flexion and extension of the spine.
- Also act as “shock absorbers” of the spinal column.
- This may have an impact on osteoporotic compression fracture.

Normal Intervertebral Disc

COLLAGEN TYPE II, IX, X

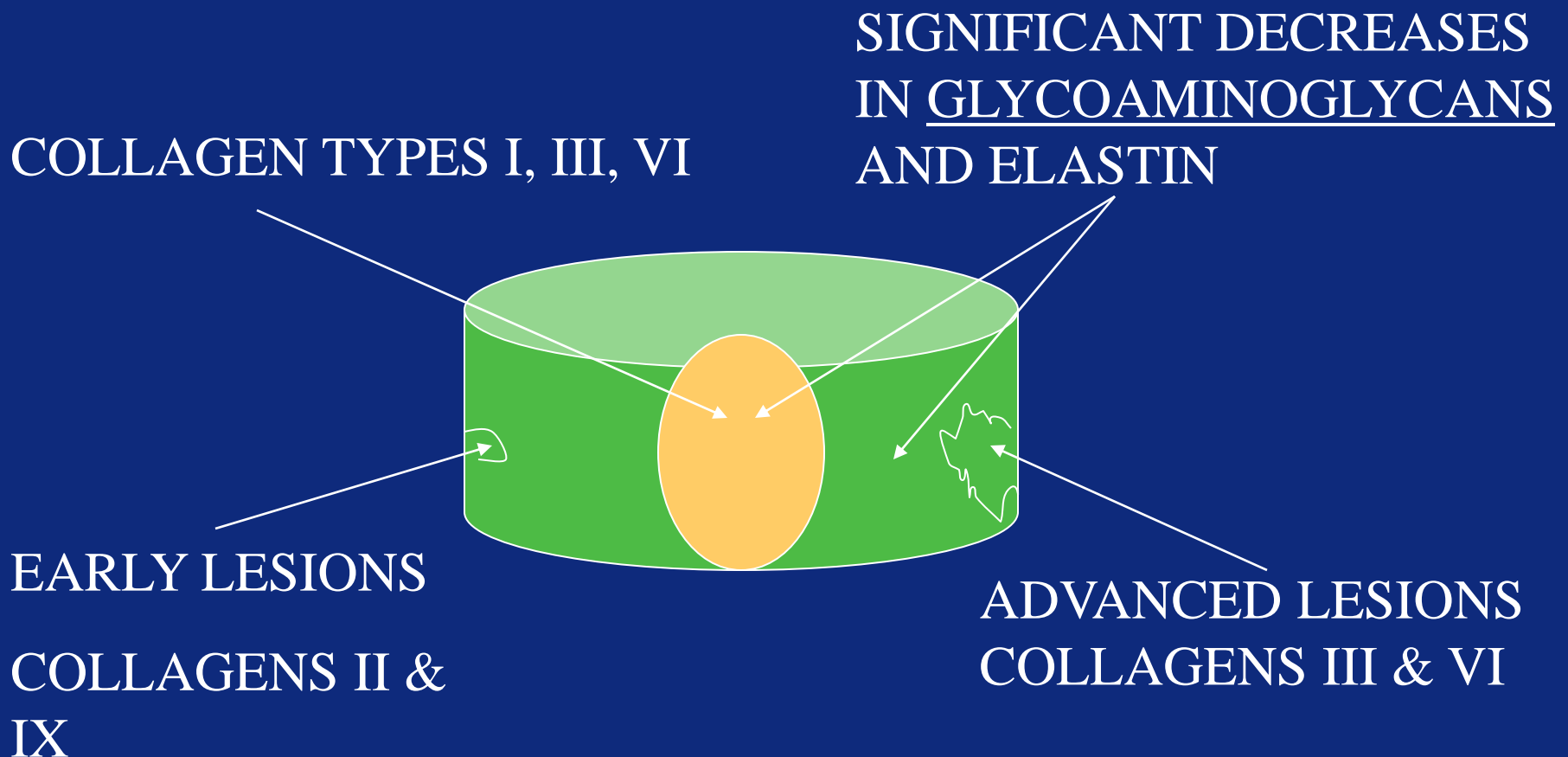
COLLAGEN TYPES II &
IX - INNER LAMELLAE

COLLAGEN TYPE I
OUTER LAMELLAE

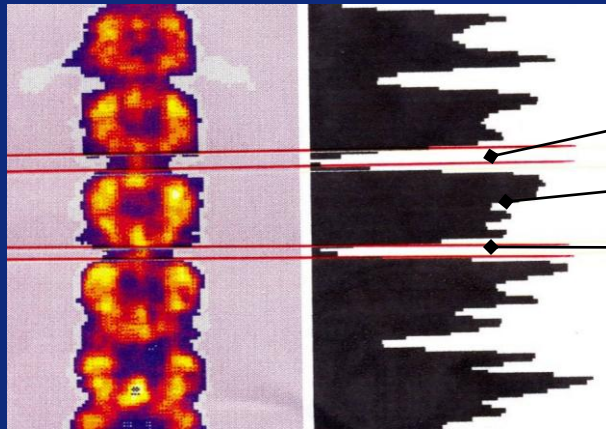


COLLAGEN
TYPES II & IV

Aged Intervertebral Disc



Methods

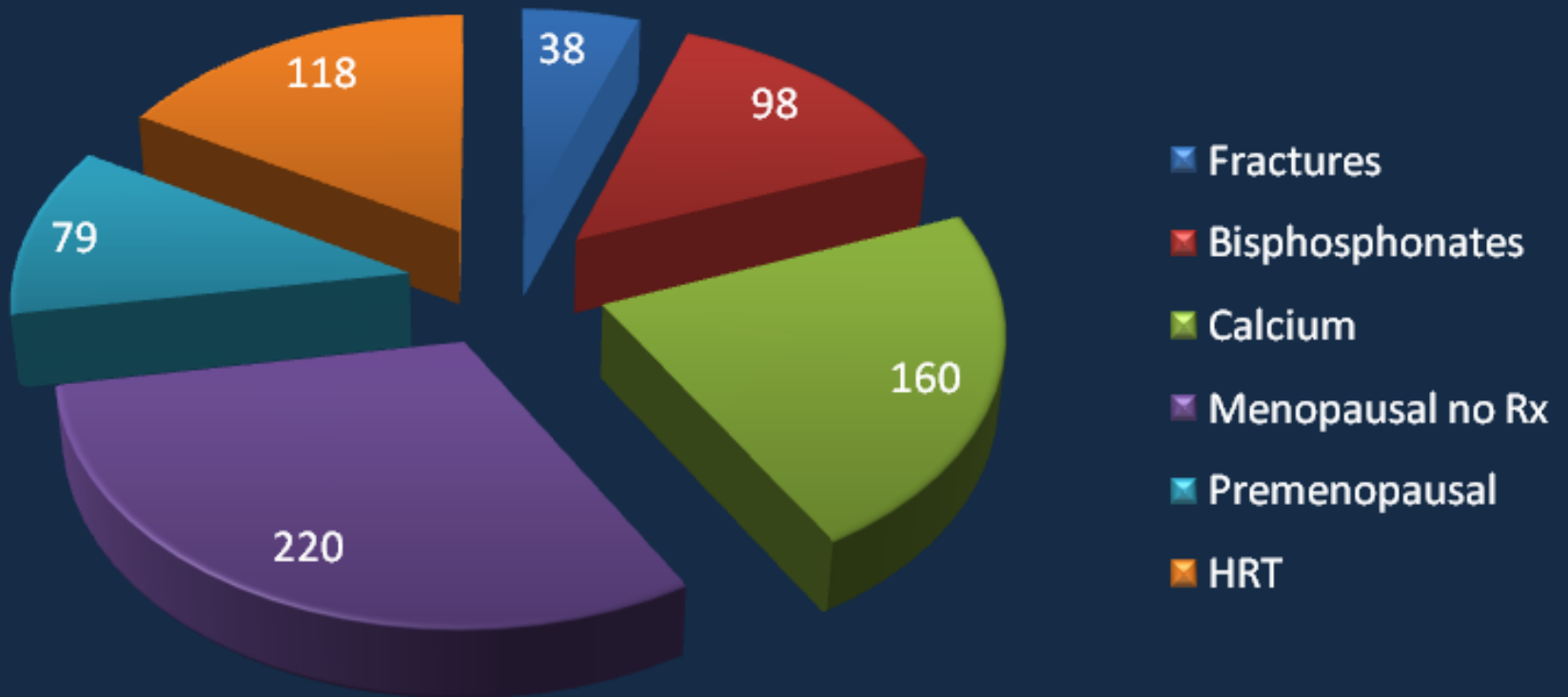


- ◆ Disc = 0.75cm
- ◆ Vertebra = 2.7cm
- ◆ Disc = 0.75cm

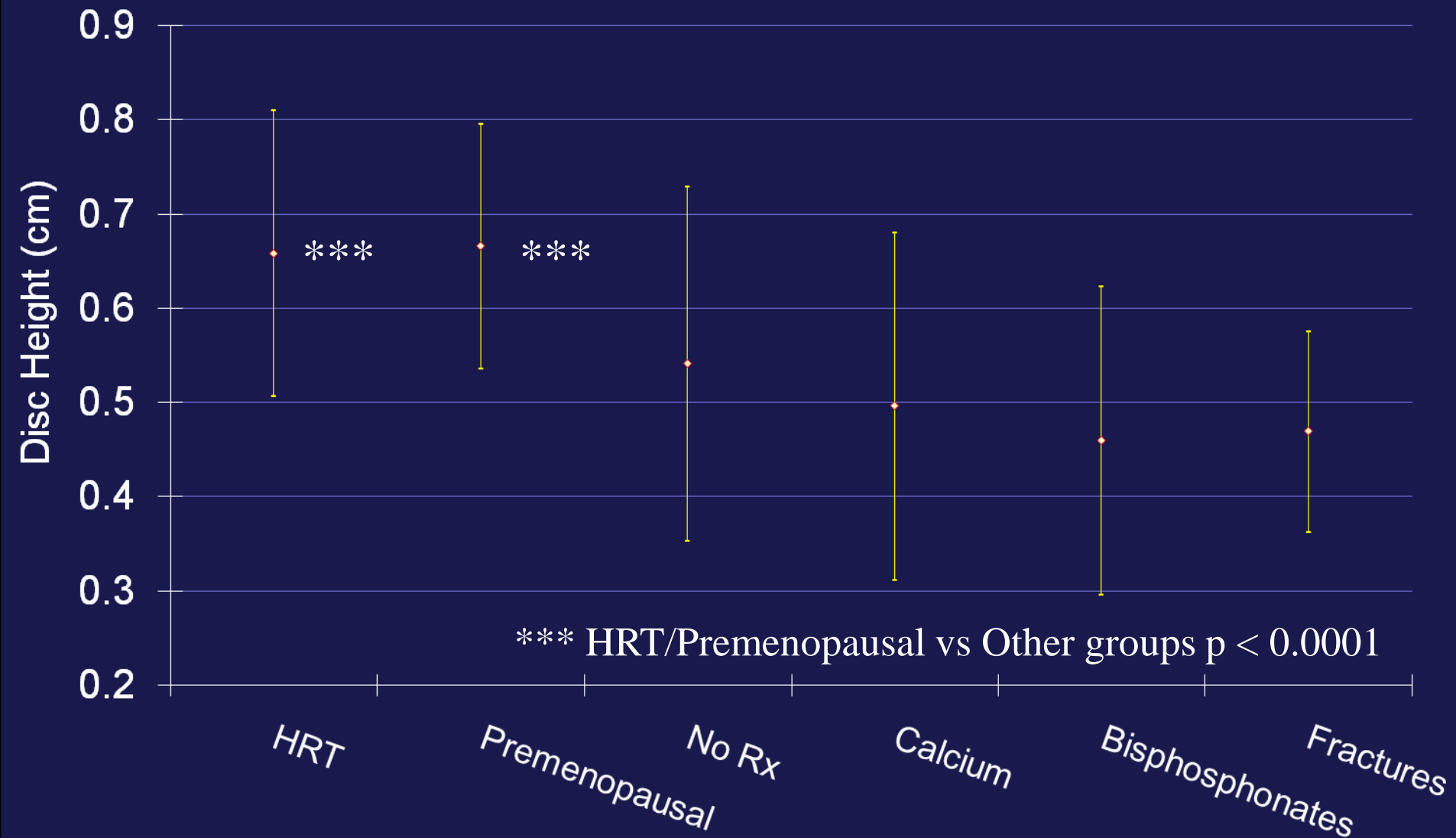
Intervertebral Disc Height measured by applying cursors to the edges of the discs using the adjacent grayscale to increase accuracy.

Group	No.	Ht	Wt	Age	Menopause Age	T-Score
Fractures	38	150	59.2	70.2	48.4	-3.1
SD		5.5	8.6	6.3	4	0.6
Calcium	160	154.1	65.68	59	48.24	-1.28
SD		6.71	11.5	9	5.1	1.4
Bisphosphonates	98	152.89	61.61	60.45	48	-2.21
SD		6.56	12.7	8.38	5.22	1.06
Menopausal no Rx	220	154.7	66.2	57.9	46.6	-1.4
SD		7.4	13.7	8.9	5.4	0.32
Premenopausal	79	157.388	65.28	45.35	N/A	-0.38
SD		4.7466	14.79	8.19	N/A	1.3789
HRT	118	155.327	67.89	51.448	44.368	-0.25
SD		6.57	15.69	6.811	6.08	1.4

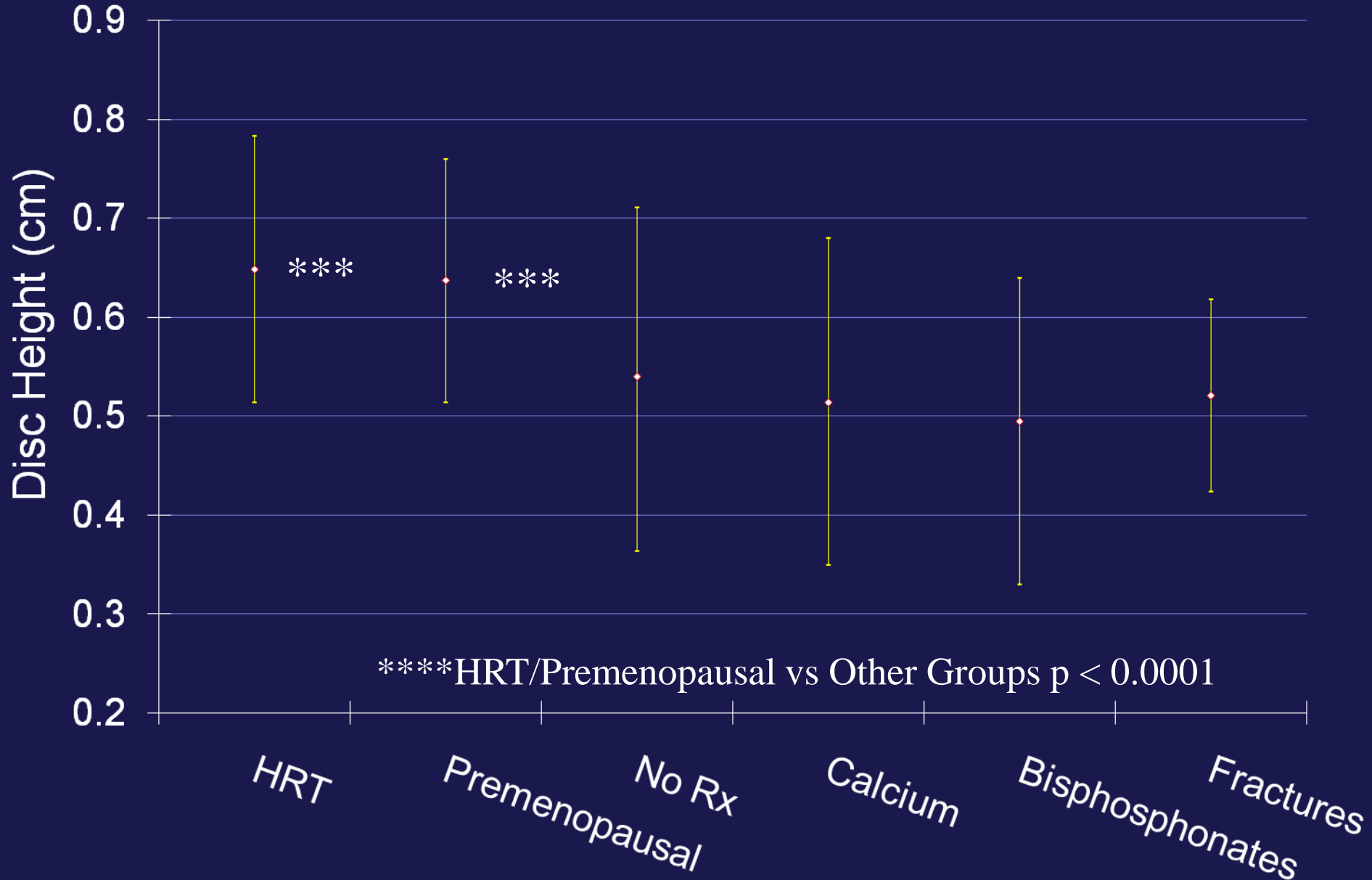
Patients by Category



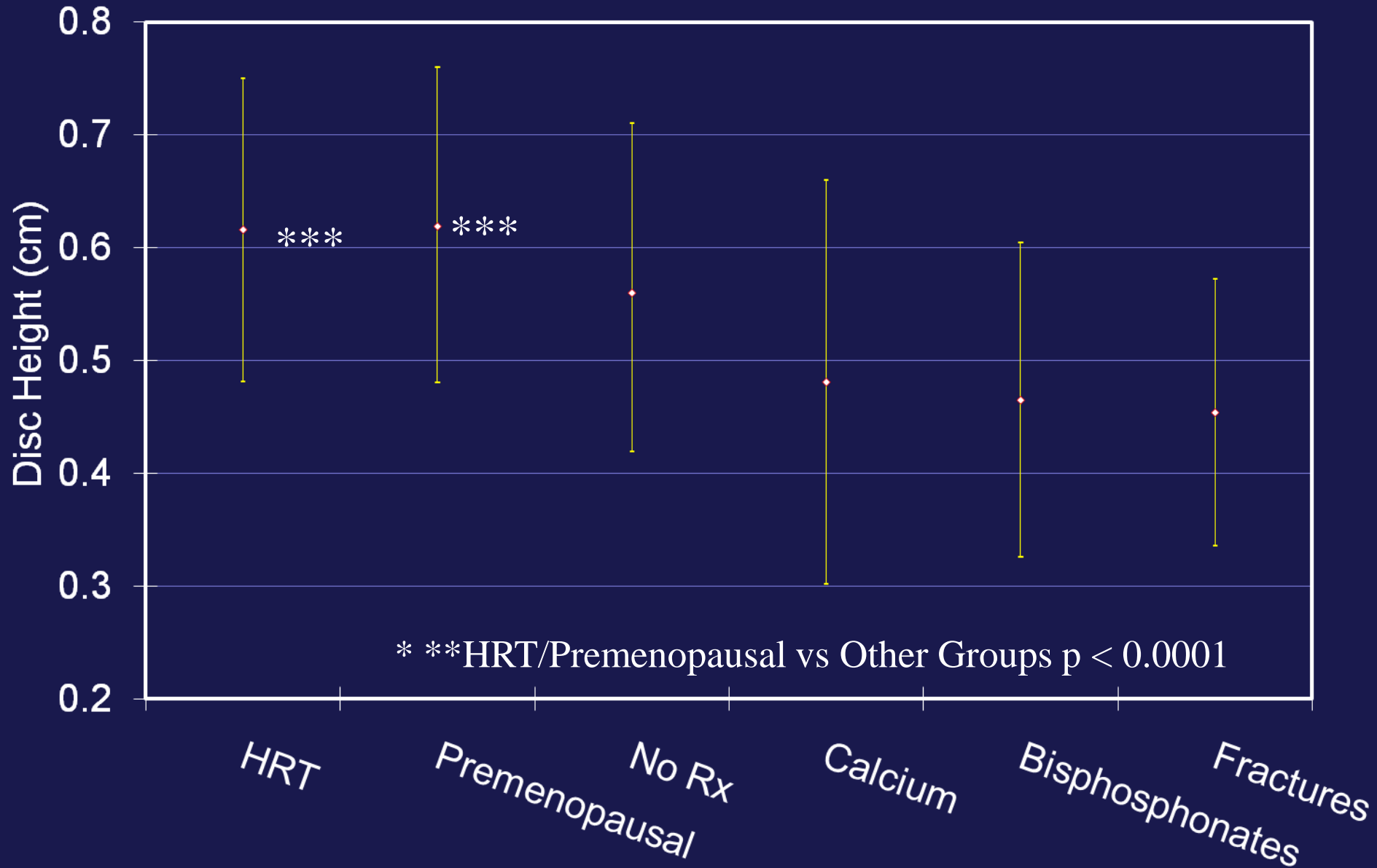
D1 Disc Height in various groups of women



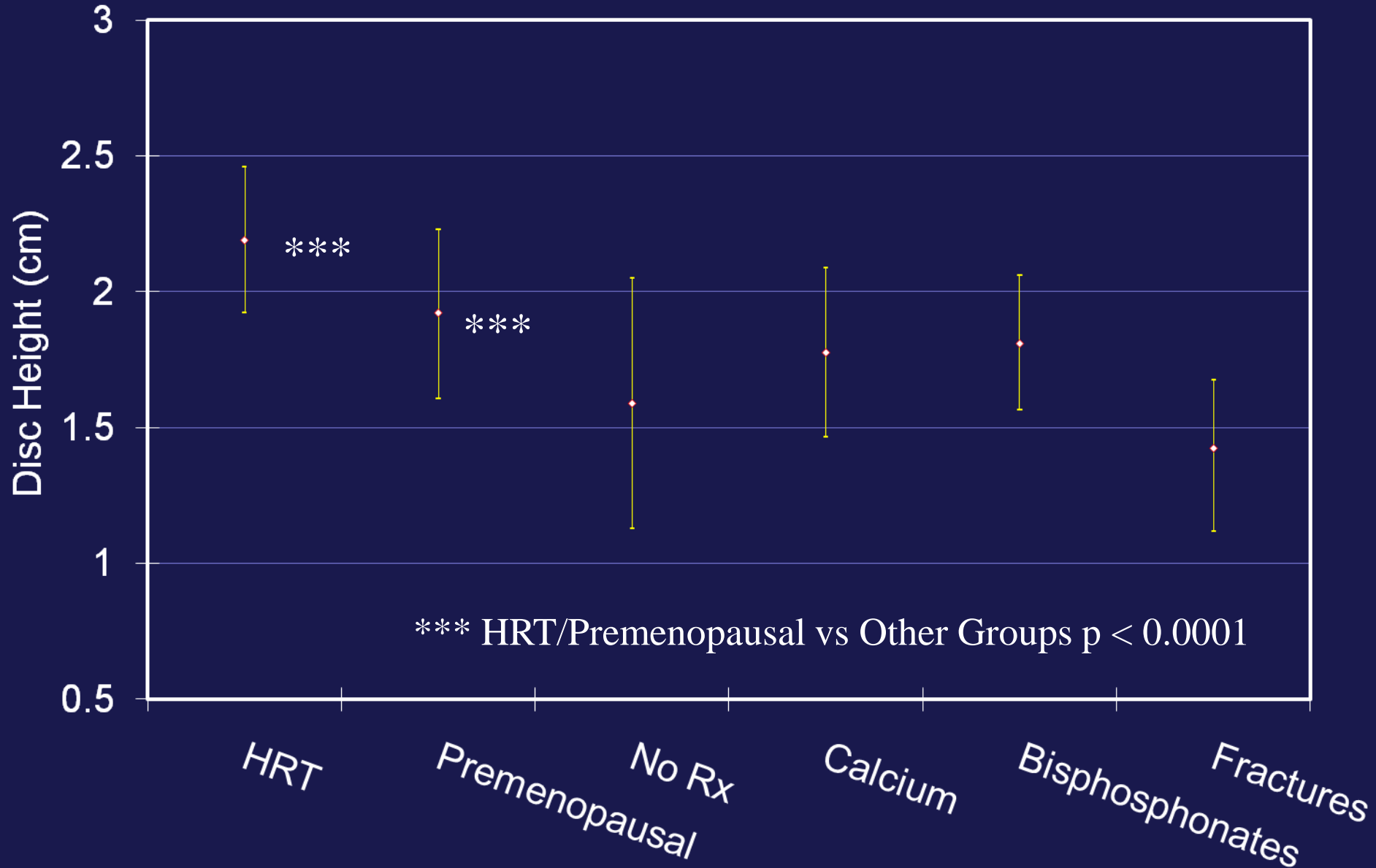
D2 Disc Height in various groups of women

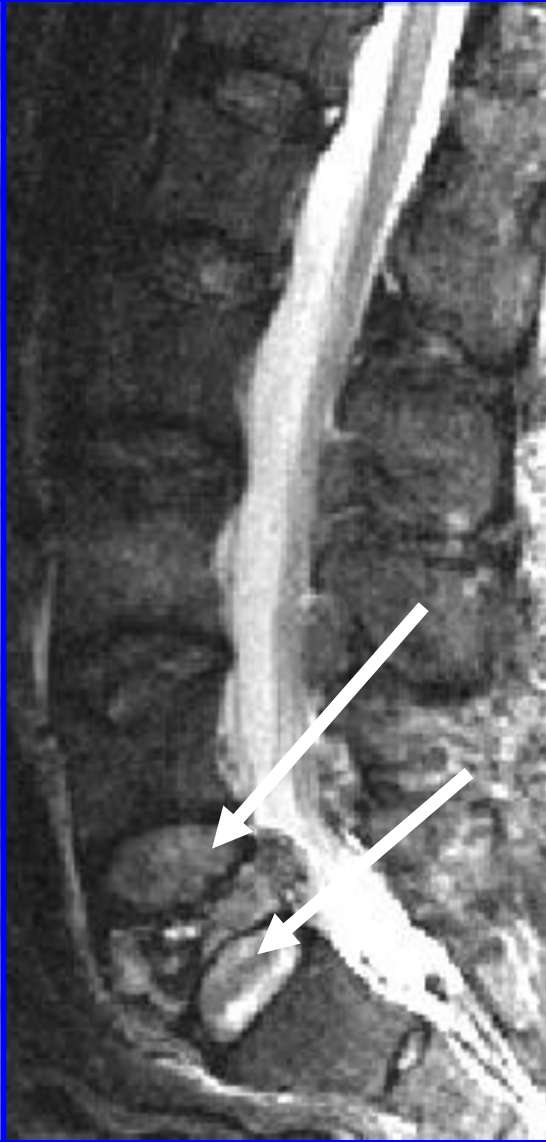


D3 Disc Height in various groups of women

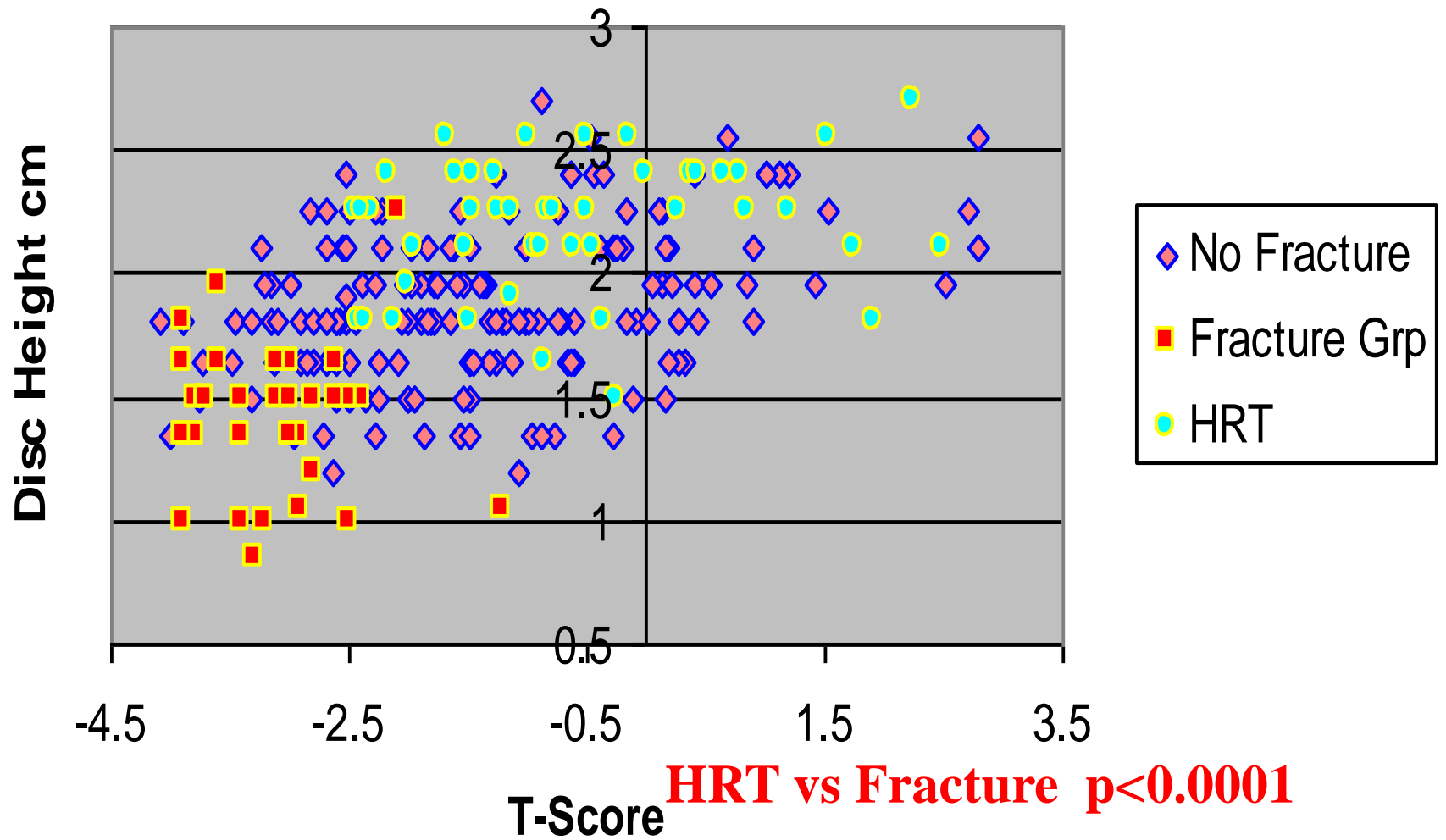


D1-3 Disc Height in various groups of women





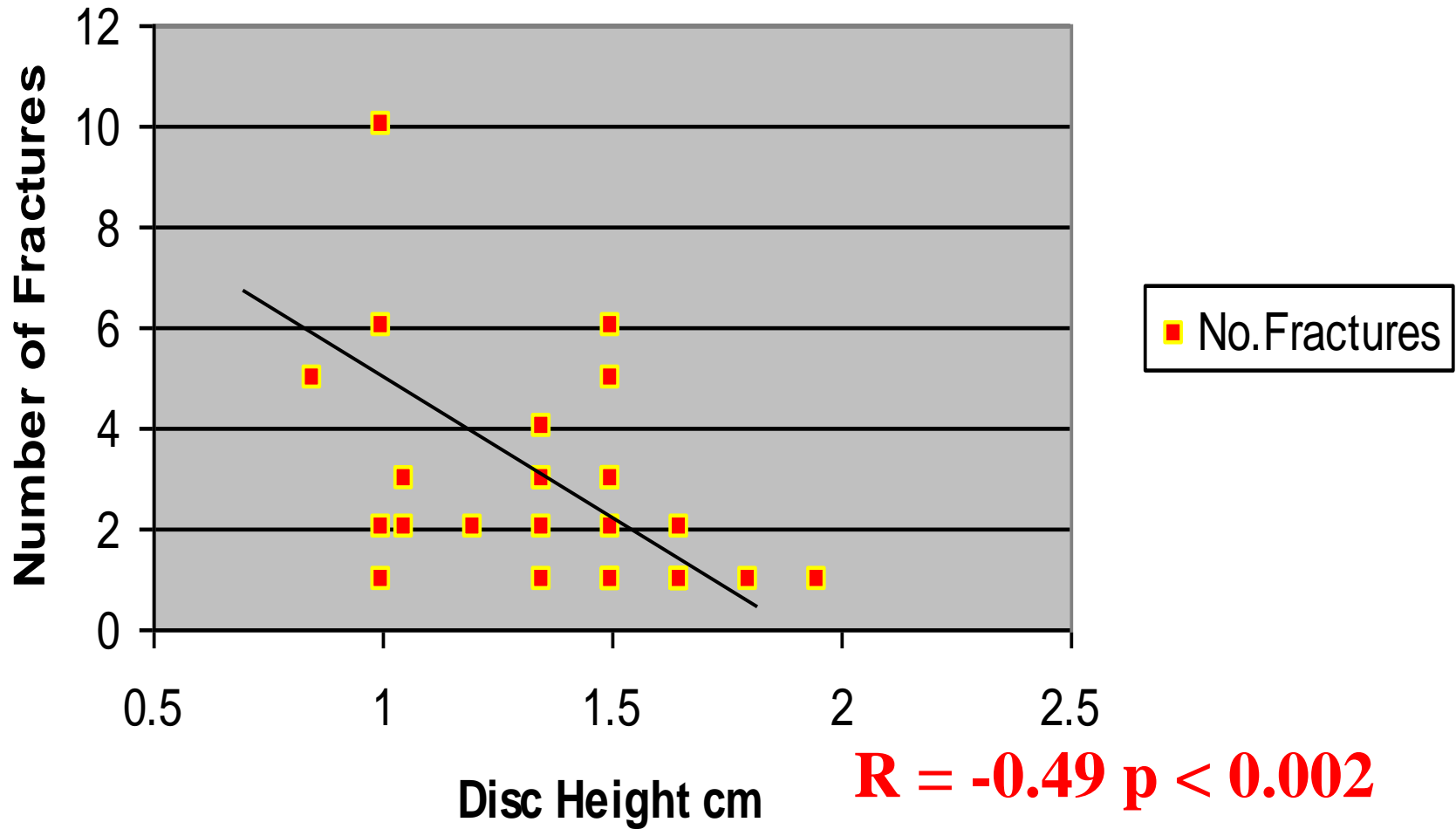
Disc Height versus T-Score



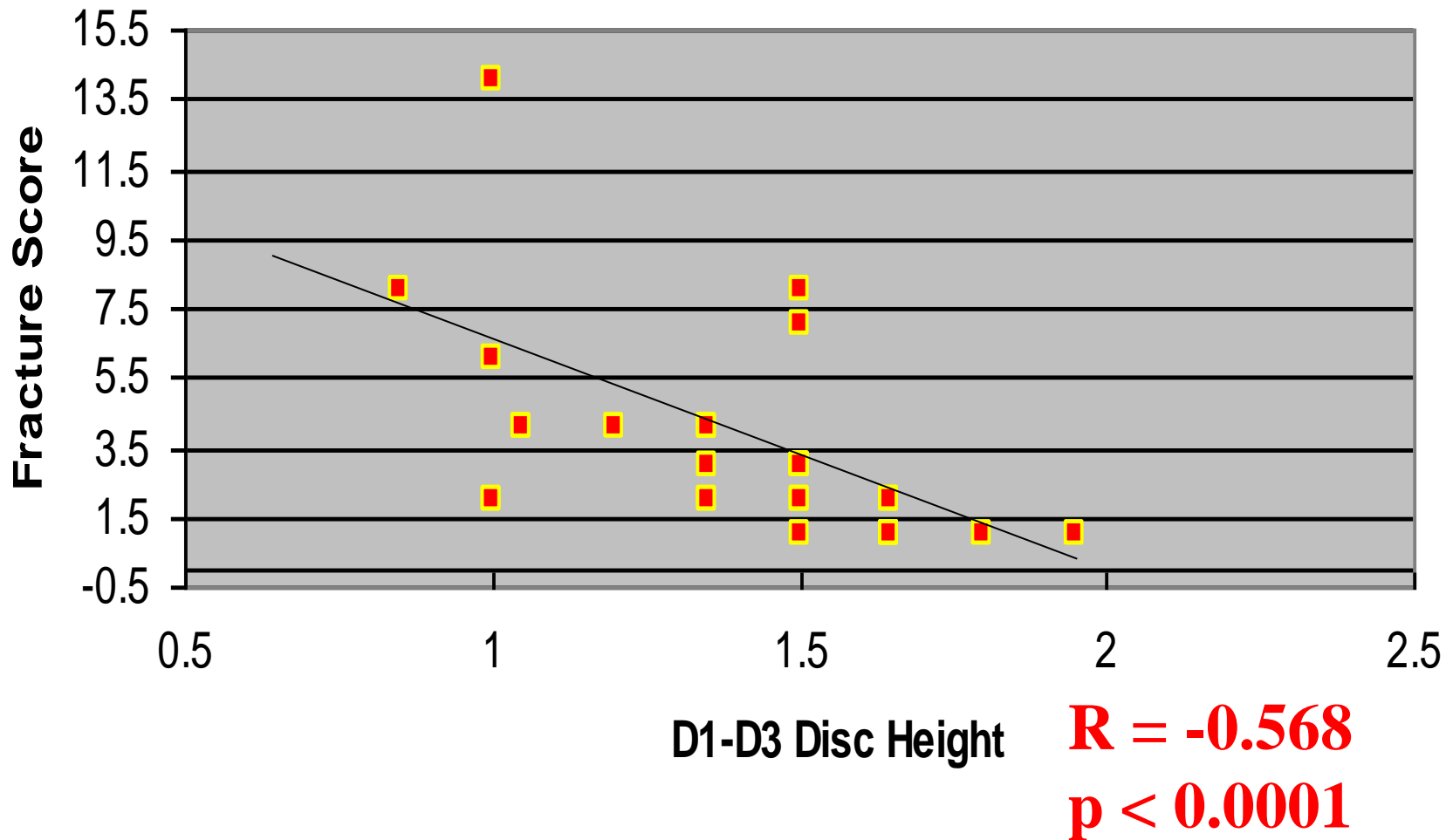
HRT vs Fracture $p < 0.0001$

HRT vs No Fracture $p < 0.0001$

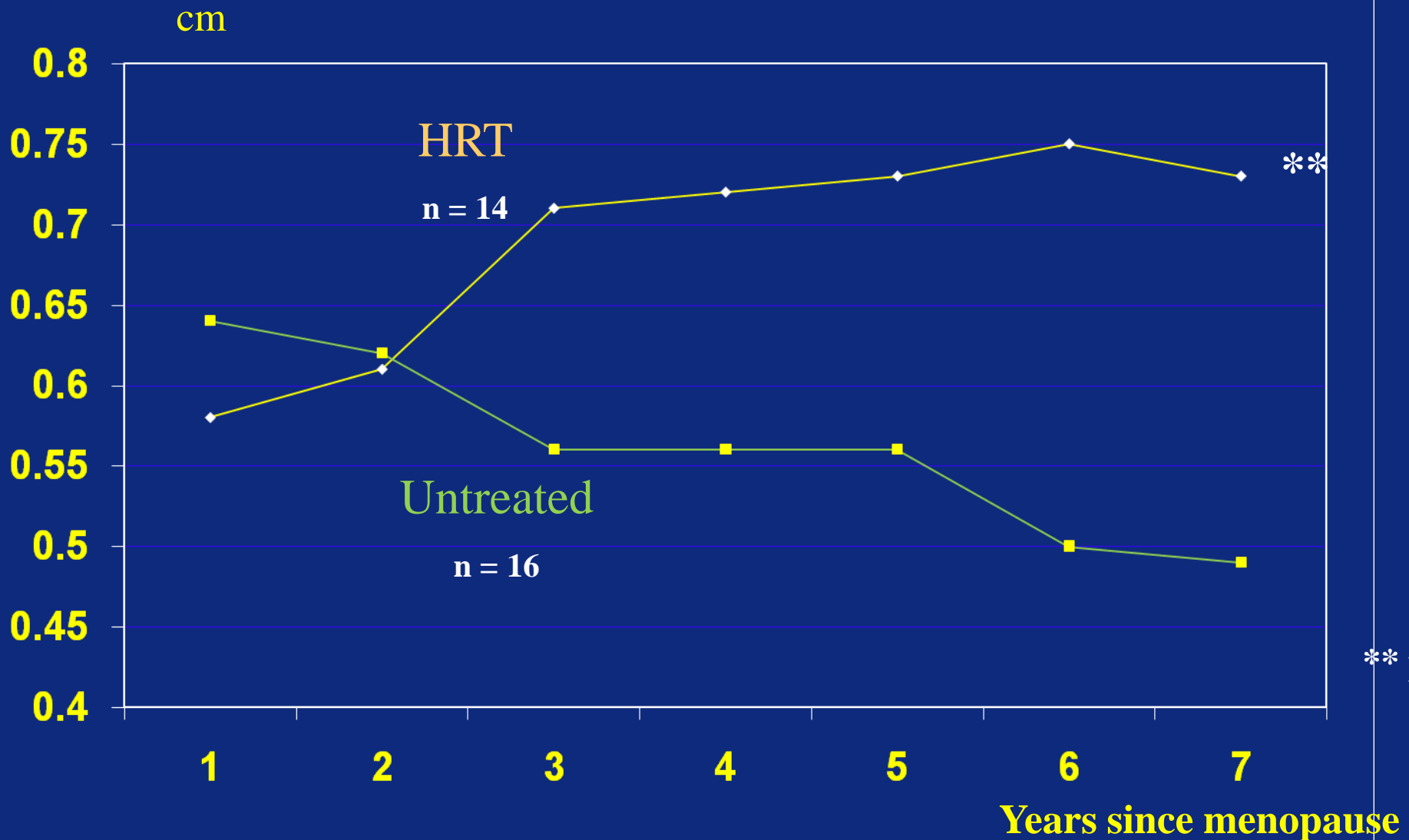
Disc Height versus Number of Fractures



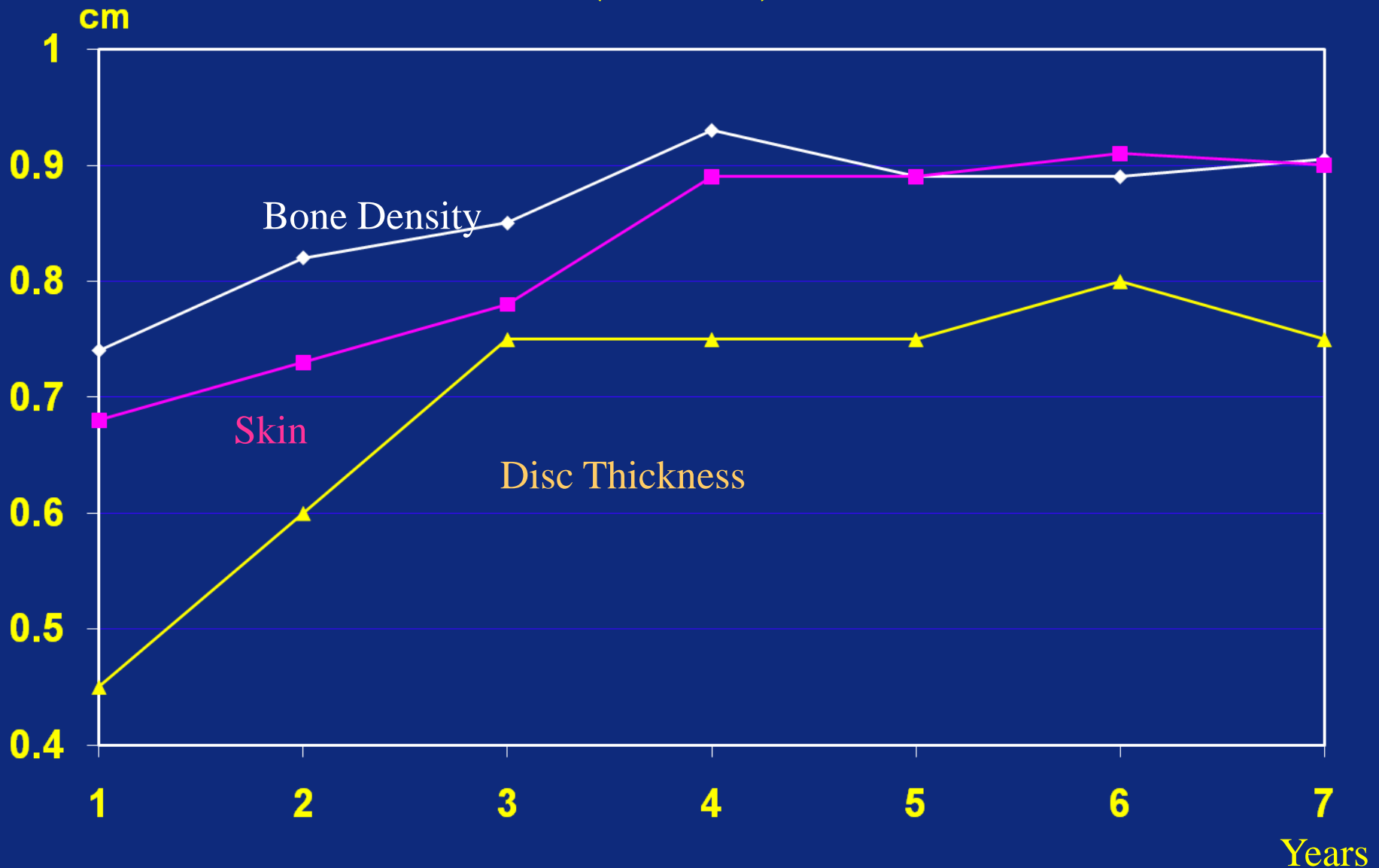
Intervertebral Disc Height (D1-D3) versus Fracture Score (Fracture Number x Grade)



Disc Thickness in HRT and Untreated Women (Corticosteroids)



Bone density, skin and disc thickness (HRT)



Conclusion

- Intervertebral Discs are an important component of the spinal column (20% of spinal height & Fluid Pump function).
- Hormone treated and premenopausal women have thicker intervertebral discs than untreated postmenopausal women
- Alterations in the extracellular matrix in the intervertebral discs appear to be intimately related to the menopausal process.

Conclusion

- Intervertebral disc thickness may have an important role in vertebral fracture. Healthy discs act as shock absorbers, distributing forces applied to the spine.
- Loss of disc height may predate osteoporotic fracture.
- Therapeutic agents influencing the extracellular matrix such as HRT, may maintain disc height and possibly prevent osteoporotic vertebral fracture.

Acknowledgements

Dr R. Galea MD, FRCOG.

Dr N. Calleja MD MSc. (Medical Statistics)

Thank you



Related Publications

Brincat M, Moniz C F, Studd J W W , Darby A J, Magos A, Cooper D.

Sex Hormones and skin collagen content in postmenopausal women

Br Med J 1983;287:1337-38

Brincat M, Moniz C J, Studd J W W, Darby A, Magos A, Emburey G, Versi E.

Long term effects of the menopause and sex hormones on skin thickness.

Br J Obstet Gynaecol 1985;92: 256-259.

Related Publications

Brincat M, Moniz C J, Kabalan S, Versi E, O'Dowd T, Magos A L, Montgomery J, Studd J W W.

Decline in skin collagen content and metacarpal index after the menopause and its prevention with sex hormone replacement.

Br J Obstet Gynaecol 1987; 94: 126-129.

Versi E, Brincat M, Cardozo L D, O'Dowd T, Cooper D, Studd J W W.

Correlation of urethral physiology and skin collagen in postmenopausal women.

Br J Obstet Gynaecol 1988;2:147-152.

Related Publications

Brincat M, Galea R, Muscat Baron Y, Xuereb A
Changes in bone collagen markers and in bone density in
hormone treated and untreated postmenopausal women.
Maturitas 1997; 27(2): 171-177.

Muscat Baron Y, Brincat M, Galea R.
Carotid artery wall thickness in women treated with
hormone replacement therapy.
Maturitas 1997; 27: 47-53

Related Publications

Muscat Baron Y, Galea R, Brincat M

Carotid artery wall changes in oestrogen treated and untreated postmenopausal women.

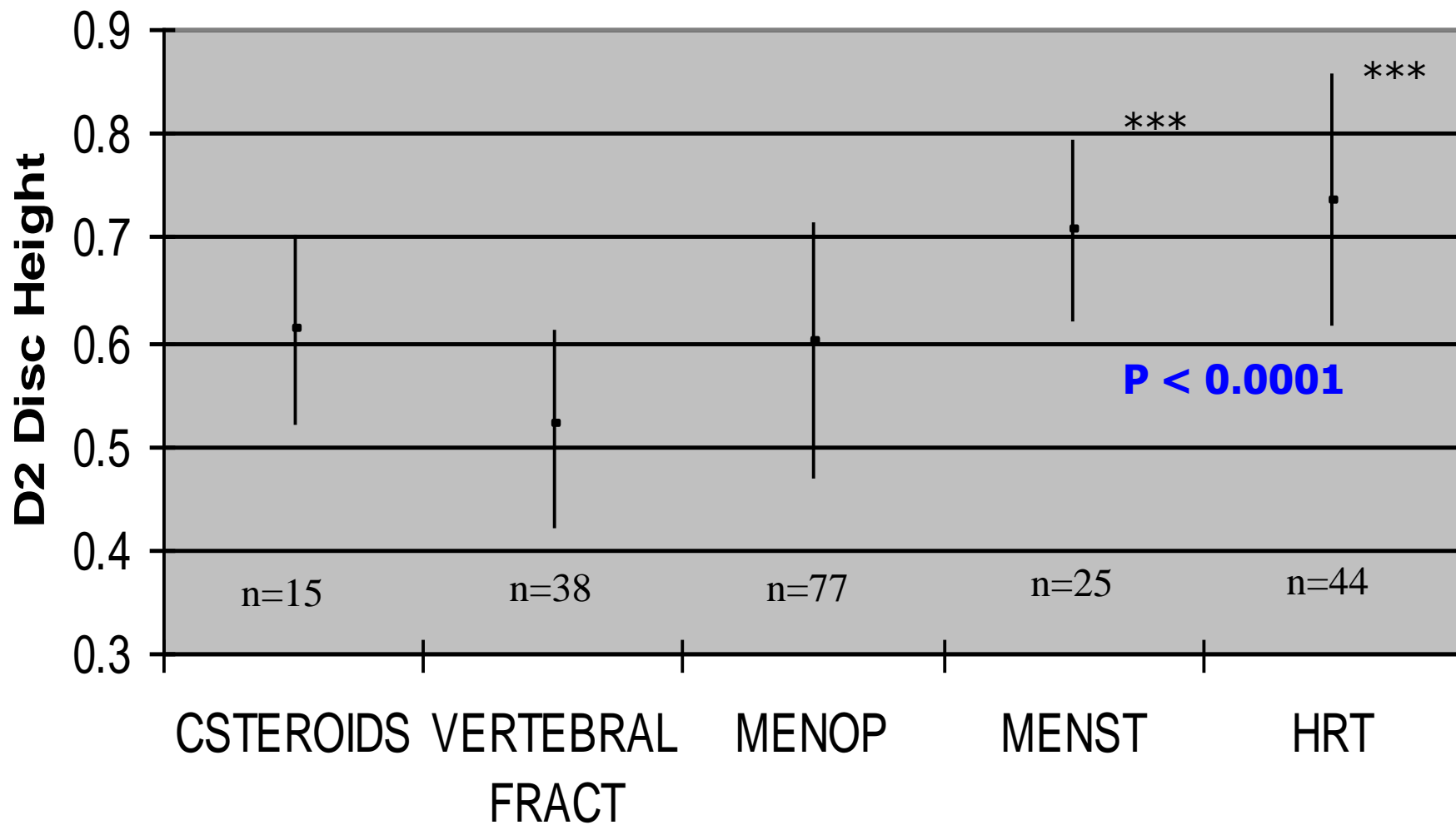
Obstetrics & Gynaecology (1998) vol 91 No. 6, 982-86.

Muscat Baron Y, Brincat M, Galea R, Calleja N.

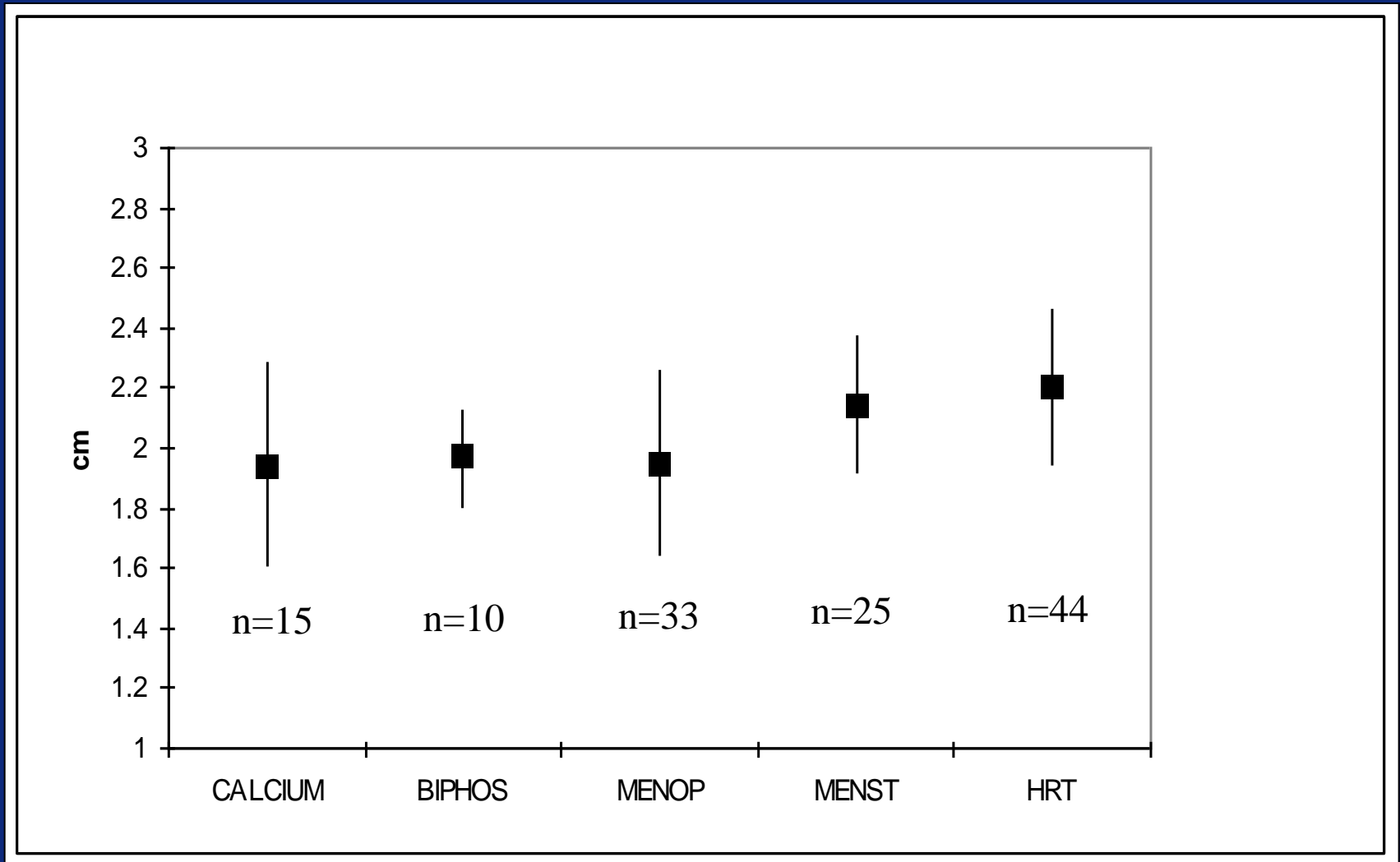
Intervertebral disc height in treated and untreated overweight post-menopausal women.

Human Reproduction 2005 in press

Intervertebral Disc Height D2



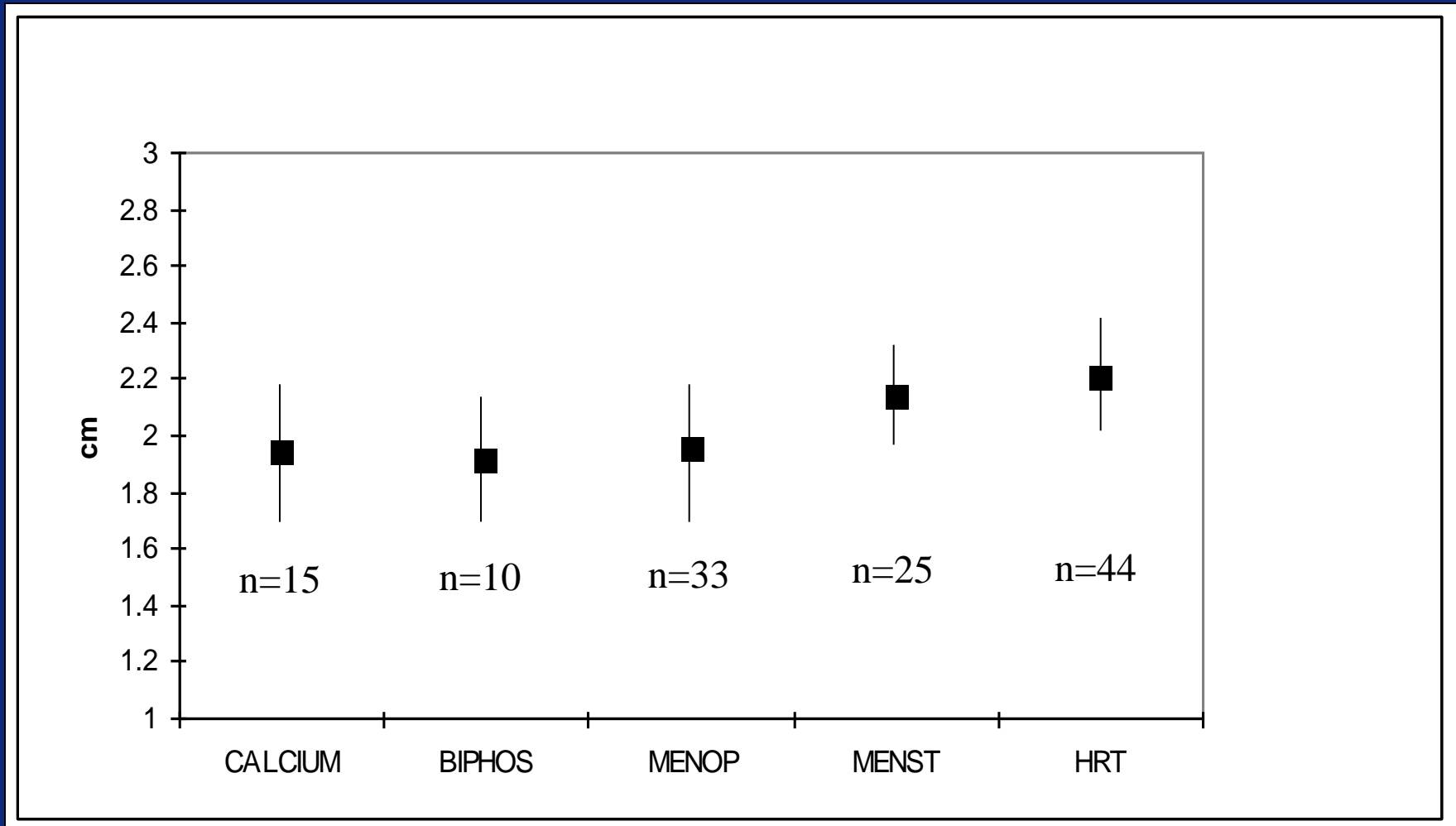
LUMBAR DISC 2 THICKNESS IN DIFFERENT GROUPS OF WOMEN



HRT/MENS vs MENOP, BIS, CAL $P < 0.03$

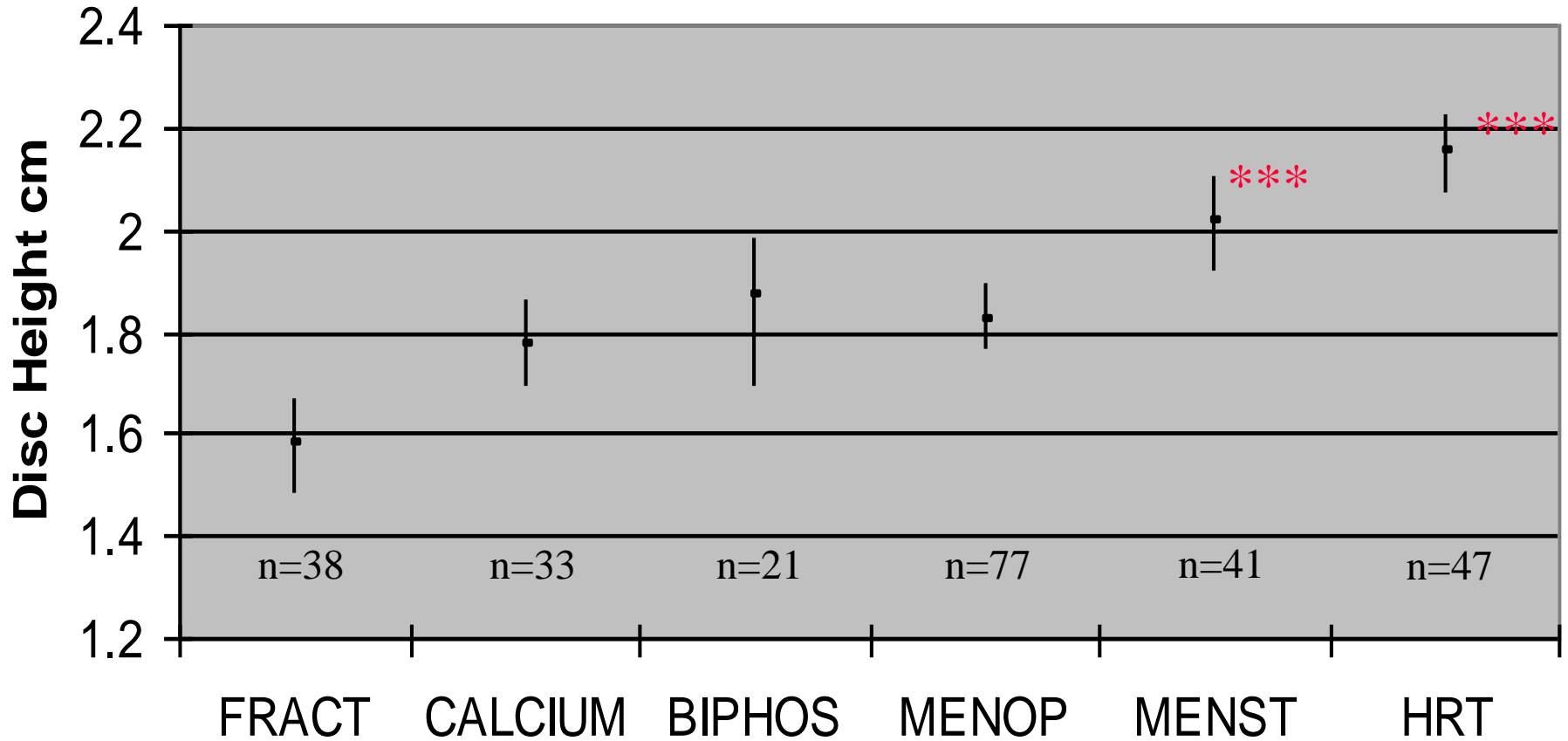
TOTAL INTERVERTEBRAL DISC HEIGHT IN DIFFERENT GROUPS OF WOMEN

D1 – D3 TOTAL LENGTH



** HRT / MENS vs MENO,CAL P < 0.04

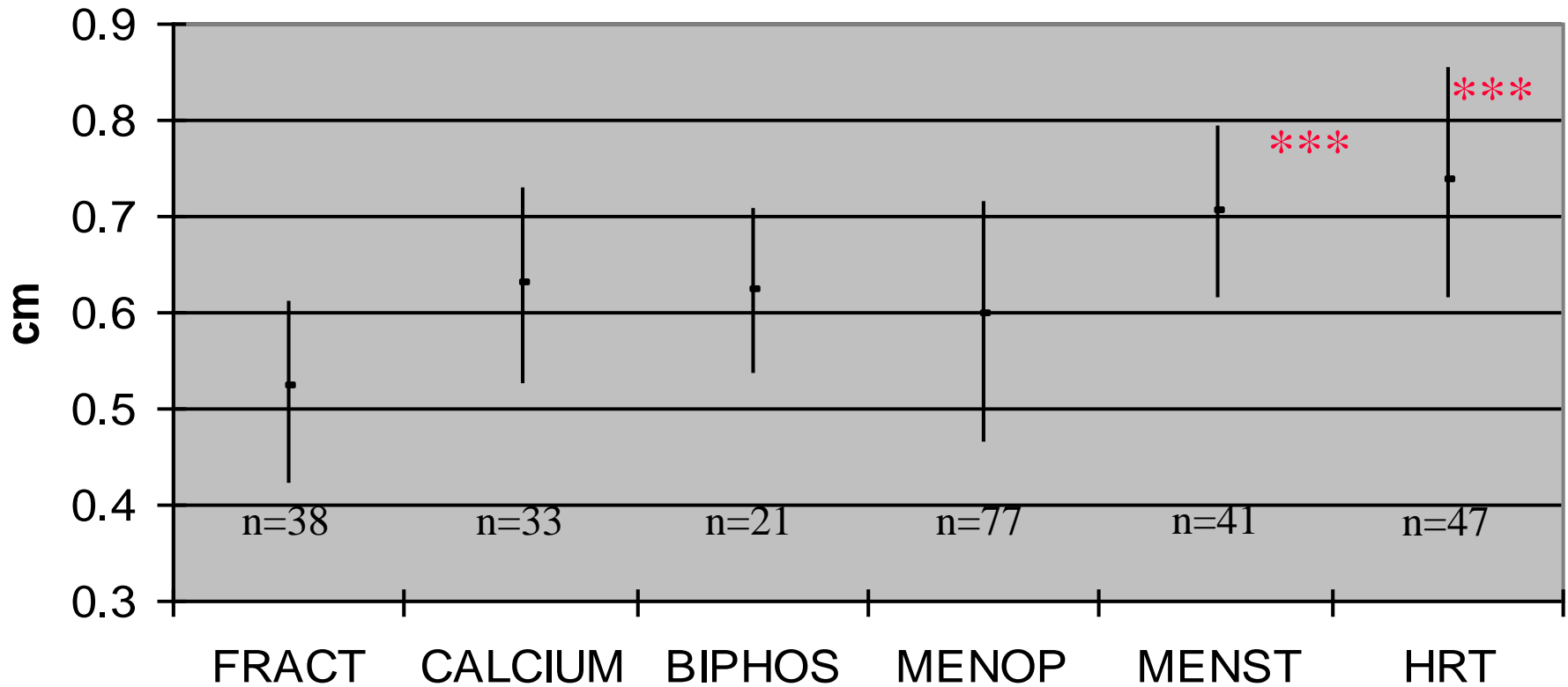
Intervertebral Disc Height D1-D3 (Corrected for Age and Weight)



***HRT/MENSTR vs MENOP,BIS, CALC,FRACTURE P < 0.0001

LUMBAR DISC 2 THICKNESS IN DIFFERENT GROUPS OF WOMEN

D2 Intervertebral Disc Height



***HRT/MENSTR vs MENOP,BIS, CAL,FRACTURE P < 0.0001

Consequences of Oestrogen Therapy

Bone Loss
[Stopped and Reversed]

Genital Organs
[Improved]

CVS Effects
(incl. Carotids)

Decreased
Skin Thickness
[Reversed]

Cerebral Changes
[Alzheimer's decreased]

*Oestrogen
Therapy*

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graph TD; OT[Oestrogen Therapy] --> BL[Bone Loss [Stopped and Reversed]]; OT --> GO[Genital Organs [Improved]]; OT --> CVS[CVS Effects (incl. Carotids)]; OT --> CC[Cerebral Changes [Alzheimer's decreased]]; OT --> DST[Decreased Skin Thickness [Reversed]];
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Cartilage and Bone

Intervertebral Disc Properties

Viscoelastic Properties

Sustaining heavy loads

Distributing forces

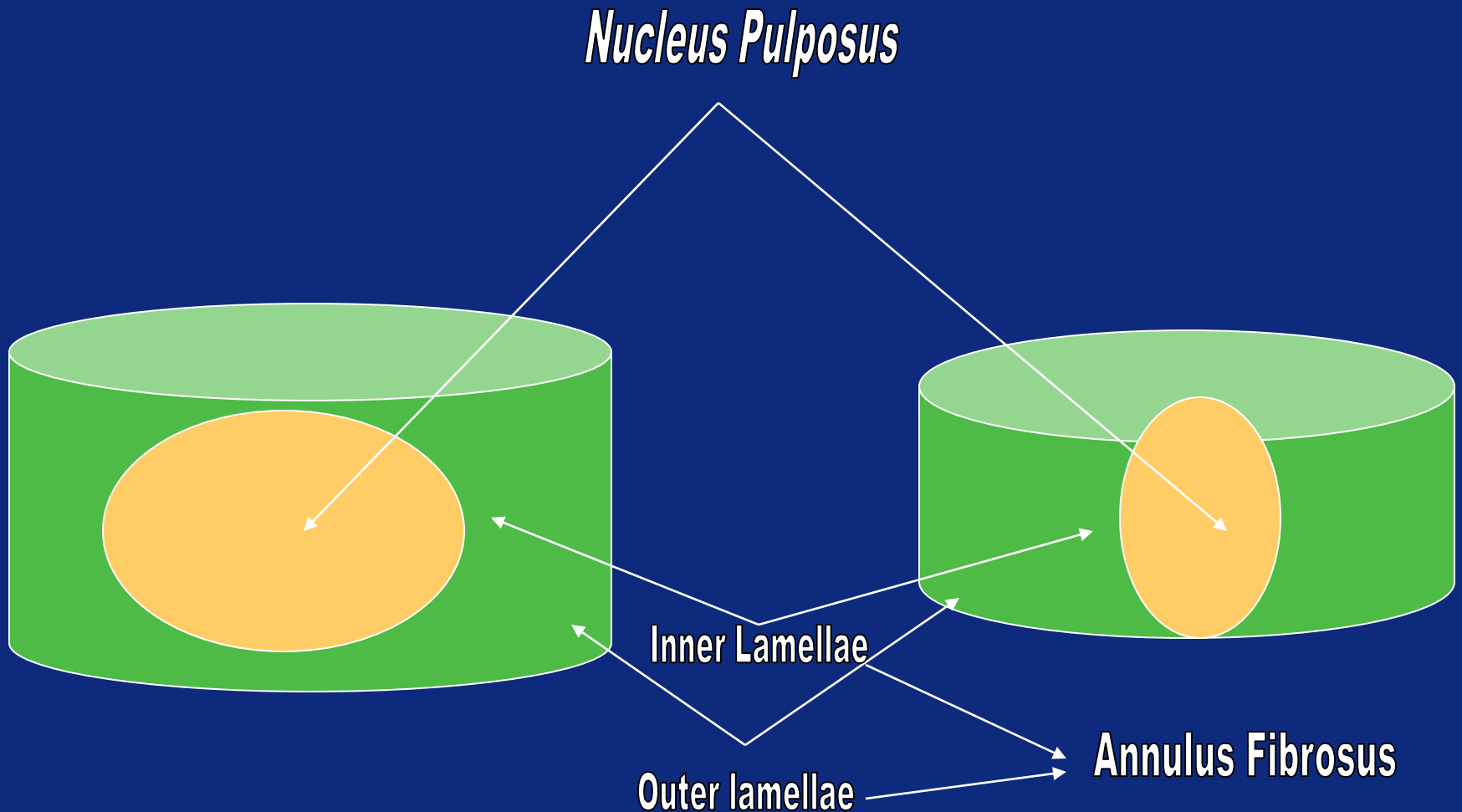
Fluid pump action: Water is pushed out into perforations in medullary cavity when disc is under pressure.

Water is regained via powerful hygroscopic activity of glycoaminoglycans.

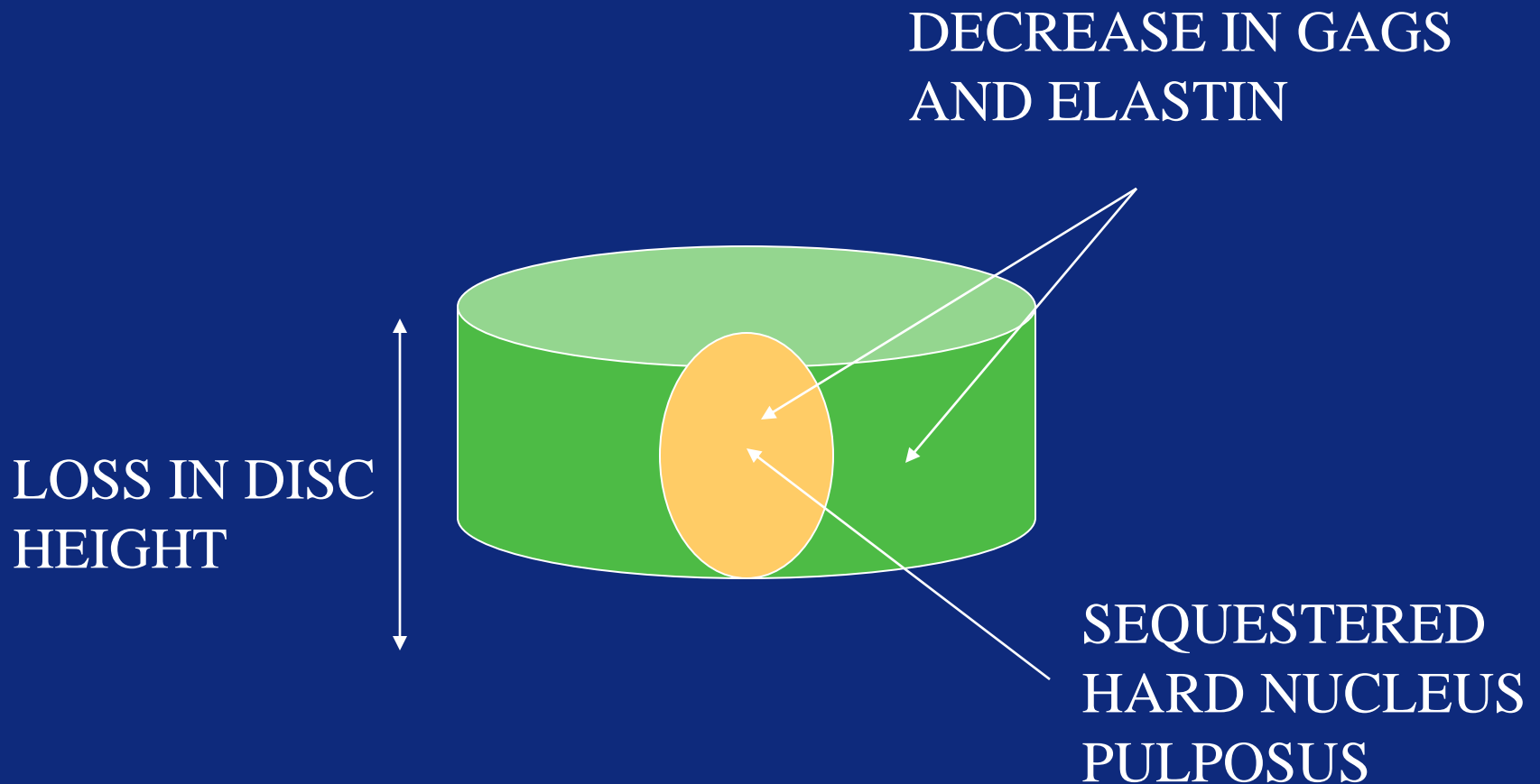
(SAGI 2003)

Normal Intervertebral Disc

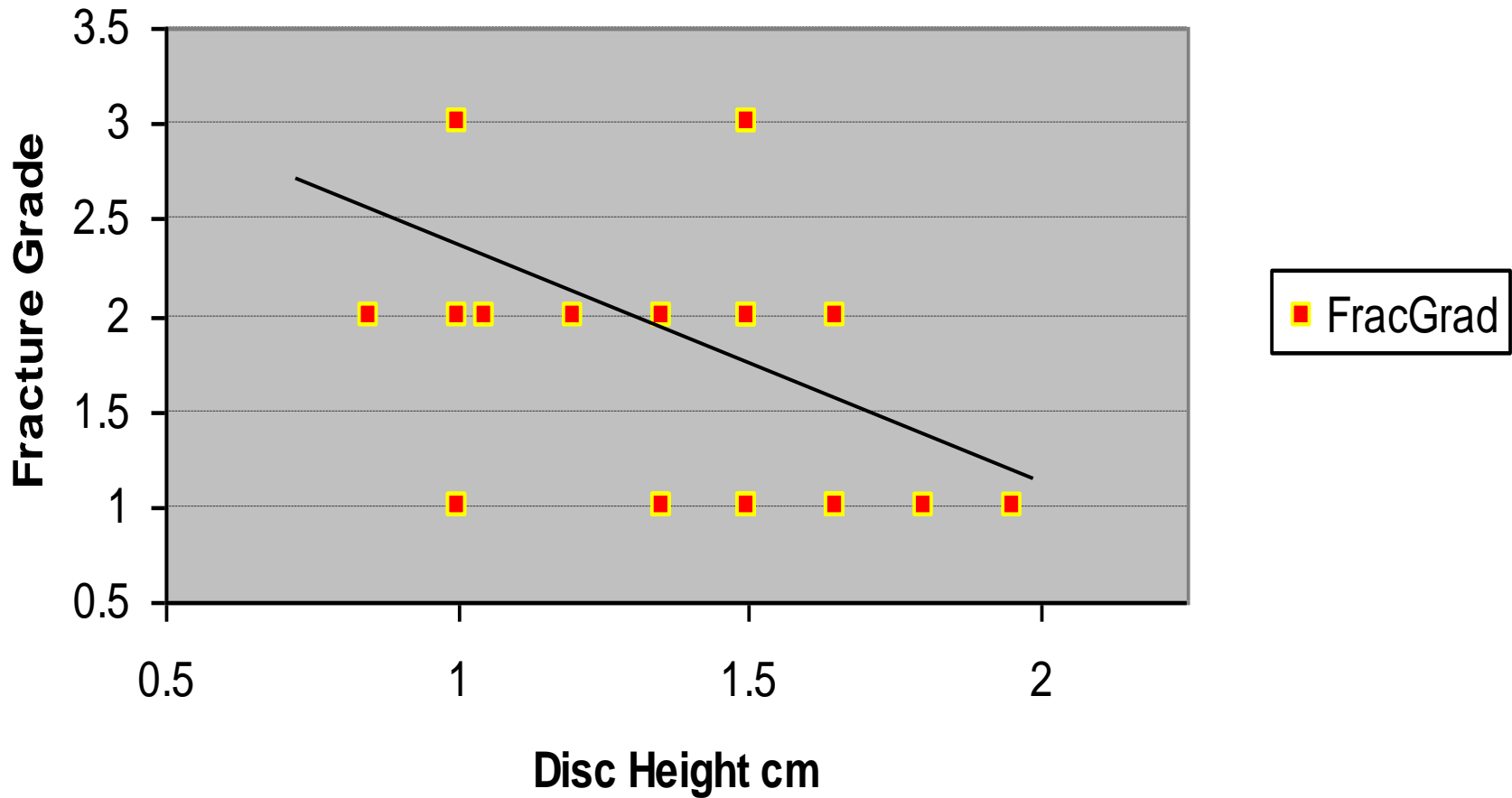
Aged Intervertebral Disc



Aged Intervertebral Disc

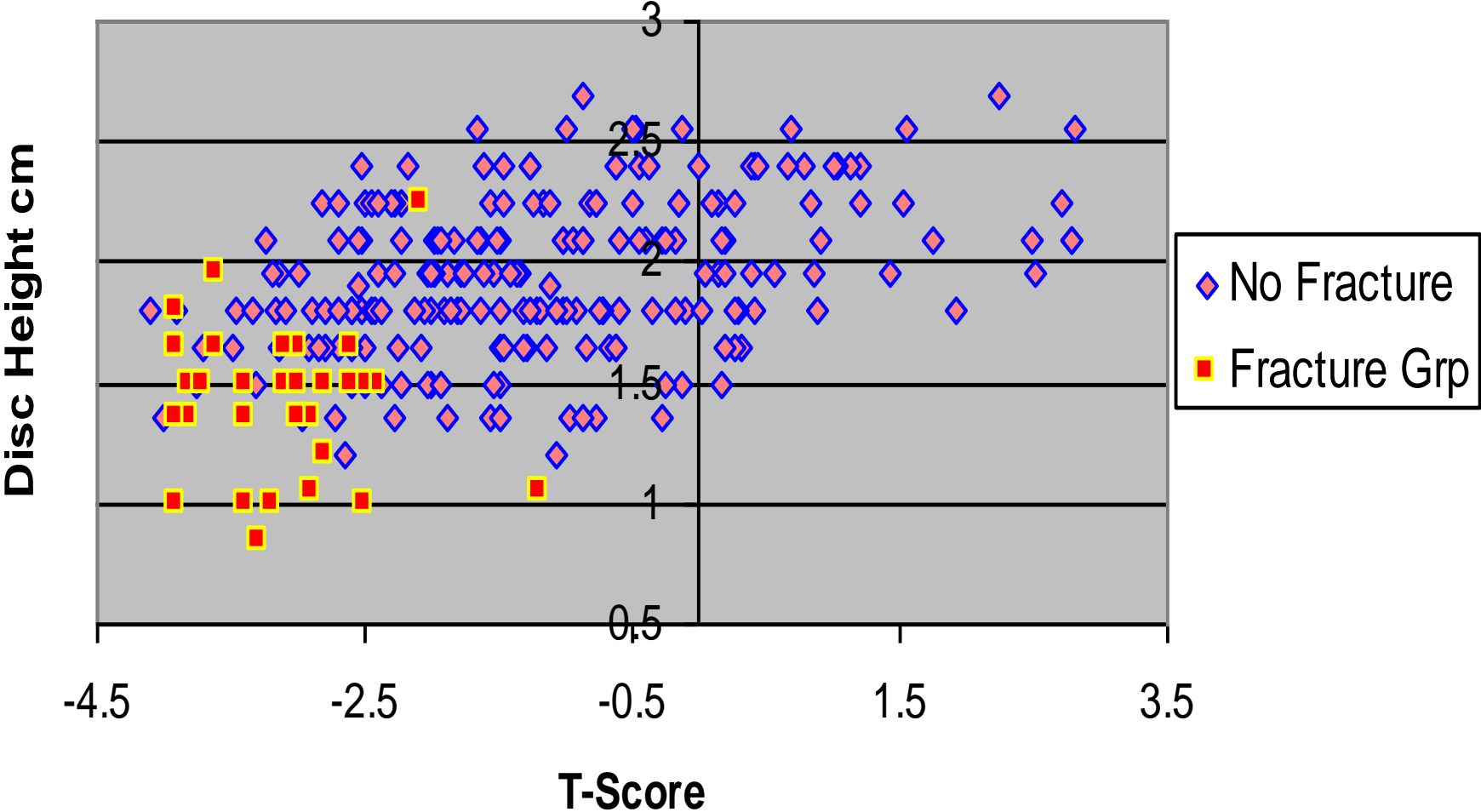


Disc Height and Fracture Grade



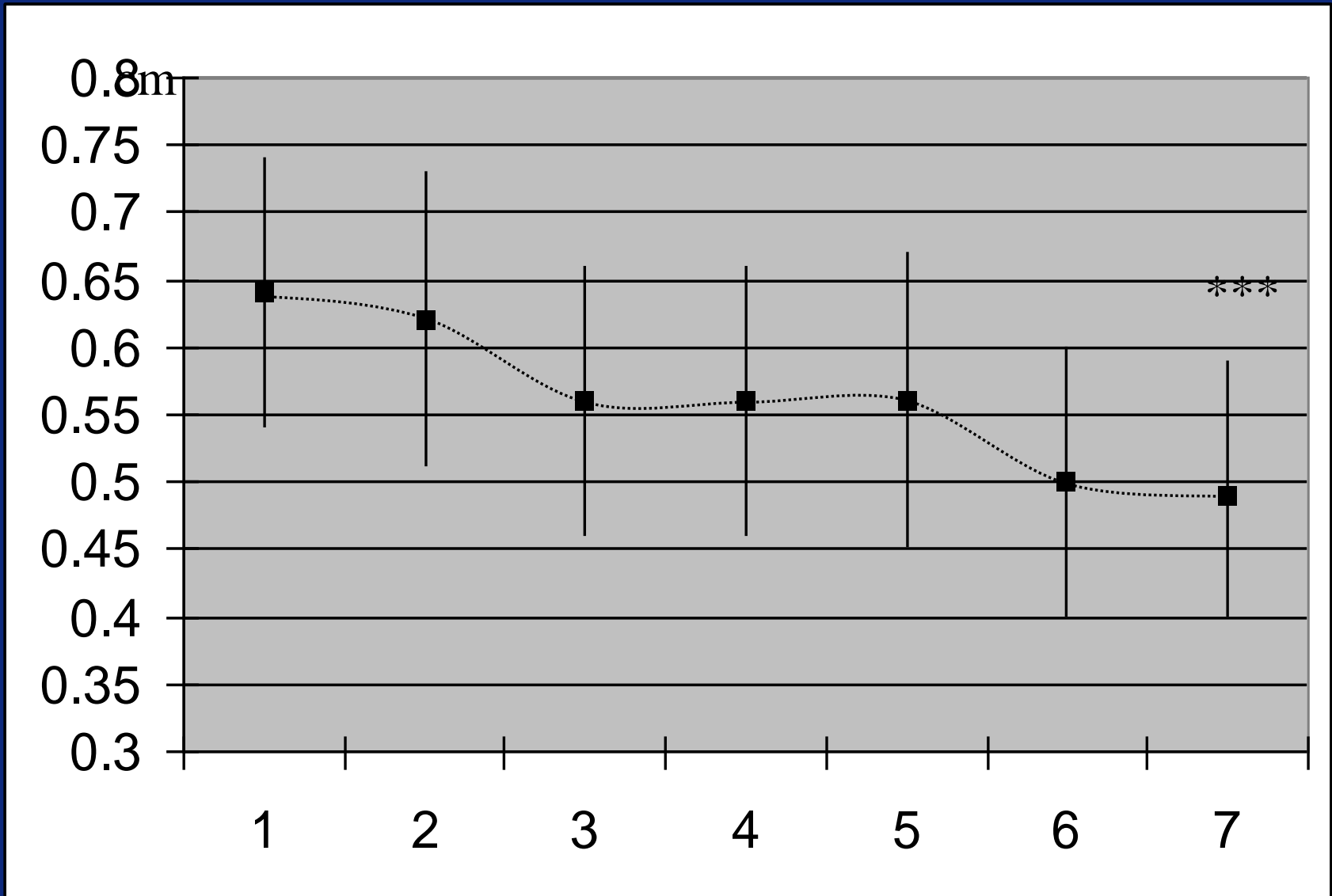
$R = -0.376$ $p < 0.02$

Disc Height versus T-Score



Fracture Grp vs NonFracture Grp $p < 0.0001$

Disc thickness in Untreated women(Corticosteroids)



P < 0.001 ***

Years since menopause

Disc thickness in HRT treated women (Corticosteroids)

