

## Bone Mineral Density by Ultrasound Densitometer in Postmenopausal Females- Preliminary Results

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### Summary

Osteoporosis so called the "silent thief" steals the strength taking mineral from the bones and is the major health problem of postmenopausal females. 35 postmenopausal females assessed for bone mineral density using ultrasound densitometer showed that 25 females were severely osteoporotic with the 'T' score  $< -3$  SD than normal young adults. 8 females showed the T score between 1-3 SD below young normals. Only 2 females had the BMD values comparable to young normals. Thus, the 71% of postmenopausal females included in this study were severely osteoporotic and had the fracture risk of 6 times higher than normal young adult.

### Introduction

Osteoporosis is characterised by the bone loss and deterioration in the microarchitecture of skeleton leading to bone fragility, fracture, independence and even death. Osteoporosis is defined as the measurement of bone mass which is 2.5 SD or more lesser than young normals of same sex (Teotia and Teotia, 1996). Osteoporosis is recognised as one of the major postmenopausal problems in our country. The prevention of osteoporosis through improvement in dietary habits, lifestyle considerations and supplementation of HRT has been the main dilemmas of treatment of osteoporosis (Teotia and Teotia 1992). The techniques such as assessment of bone mineral density (BMD) plays a vital role in confirming the diagnosis as

well as it is an aid to identify the future risk of osteoporotic fractures and improvement by various therapeutic modalities (Teotia and Teotia 1999). The BMD is relatively new in India as compared to the western countries. The present study has been conducted in postmenopausal females to assess the level of osteoporosis using BMD.

### Material and Method

The present study has been conducted taking 35 postmenopausal females between the period of Jan '99 to May '99. The average weight being 54.5 kg in the age group of 50 yrs. to 70 yrs. These patients were those postmenopausal patients who were not on any drugs e.g. steroids, heparin and thyroxin etc. and came for

various other old age problems or postmenopausal problems.

The BMD was assessed using lunar Achilles ultrasound Densitometer software version 1.3 in os calcis of right foot. The BMD was assessed as stiffness using SOS (speed of sound) and BUA values (Broad Band Ultrasound Attenuation). The ultrasound method uses the principle of sound attenuation to plot mineral density. It is non-invasive, less expensive and painless procedure.

**The formula for stiffness is:**

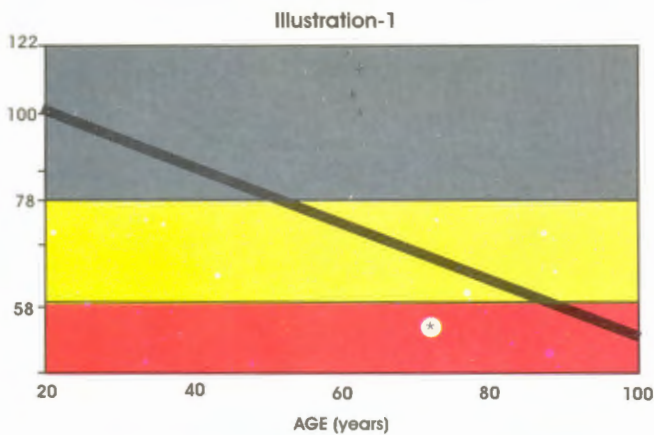
$$\text{Stiffness} = 0.67 \text{ BUA} + 0.28 \text{ SOS} - 420.$$

The results of BMD were analysed when expressed in standard deviation units in comparison to the young normals and are known as "T-scores".

Calculation formula:

$$\text{T-score} = \frac{\text{Patients BMD} - \text{Reference BMD}}{\text{Reference SD}}$$

The results were interpreted in graphic form (Illustration I).



**Bone Mineral Density of a 70 year old female**

The % Young adult value (T-score) compares a patient's stiffness value with expected value for 20 years old subject of same sex and nationality. The area labelled green at the top showed the range of stiffness value for young normal adults and considered to be normal. The bottom line of green zone marks 1 SD (11%) below the mean young adult. The yellow region represents a T-score i.e. the stiffness value are 1-3 SD lesser as compared to young normal adult. The red region represents values >3 SD lesser as compared to young normal adult of same sex and nationality. The risk of fracture doubles for each 1 SD decrease of bone mineral density.

The %age matched value (or Z-score) compares the patient's stiffness value with expected stiffness value for reference group of same age and sex. The bone mineral density declines along the normal regression line with advancing age. The bone mineral density of the female is assessed when compared with young normal adults of same sex and nationality. i.e. T-score".

**Observations**

The observations made in 35 postmenopausal females of average weight 54.5 kg, mean height 5.2 feet and mean parity P<sub>3</sub> belonging the middle and upper socioeconomic status included the age, T score, Z score, speed of sound, broad band ultrasound attenuation, % young adult and % age matched. The data has been compiled in the tabulated chart as follows (Illustration II):

**Discussion**

Out of the 35 females studied, only 10 females show % age matched (or Z-score) of >100%. This shows that only 10 females out of 35 showed a BMD which were appropriate for their age according to the normal regression line of BMD for age. Two females out of these 10 females showed the T-score of 1.03 and 0.32 respectively. Therefore, to conclude only 2 females out of 35 showed a normal BMD as compared to the young adult and rest 33 females required some form of therapeutic intervention.

The BMD of 25 females out of the 35 females studied fell in the red zone of the graph i.e. T-score >3 SD lesser than young normal adults and therefore the risk of osteoporotic fractures were 6 times higher in these females. Thus this small study showed that the 71% of postmenopausal females included in this study were found to be osteoporotic with T-score >3 SD, 23% were with T-score between 2-3 SD below young normals and 6% were without any osteoporosis. These 2 females out of 35 postmenopausal females screened did not require therapeutic intervention.

**Conclusion**

This is a small group clinical trial to study the BMD of postmenopausal patient to diagnose level of osteoporosis. We are still doing the BMD in all the age groups of Indian female population to assess the level of osteoporosis in our Indian setup. By its nature osteoporosis progresses silently for years without symptoms and is therefore a "silent bone thinning disease" without symptoms. Alerting the females at risk is one prong of campaign and dissemination of

Illustration II : Tabulated Chart of BMD Measurement

No. of Patients	Age (yrs)	% young adult	%age	T score	Z score	SOS m/s	BUA DB/MHz
n1	70	59	81	-3.75	-1.25	1485	94
n2	65	57	75	-3.94	-1.69	1475	95
n3	50	73	87	-2.47	-0.97	1518	102
n4	50	65	78	-3.16	-1.66	1489	102
n5	56	64	80	-3.29	-1.49	1509	92
n6	54	88	108	-1.09	0.61	1538	116
n7	57	57	72	-3.88	-2.03	1483	93
n8	63	63	82	-3.88	-2.03	1496	96
n9	60	79	101	-1.93	0.07	1525	108
n10	54	61	75	-3.57	-1.87	1493	94
n11	50	75	89	-2.30	-0.80	1542	95
n12	50	63	75	-3.39	-1.89	1492	97
n13	50	111	133	1.03	2.53	1550	146
n14	65	56	74	-4.00	-1.75	1522	75
n15	65	67	89	-2.99	-0.74	1505	99
n16	50	87	104	-1.21	0.29	1539	114
n17	53	68	83	-2.91	-1.26	1498	103
n18	60	77	98	-2.11	-0.11	1522	106
n19	58	52	65	-4.40	-2.50	1471	89
n20	50	78	94	-1.96	-0.46	1518	110
n21	50	69	83	-2.79	-1.29	1515	98
n22	50	61	73	-3.54	-2.04	1490	96
n23	55	62	76	-3.54	-2.04	1490	96
n24	50	80	96	-1.79	-0.29	1548	101
n25	50	81	97	-1.722	-0.22	1522	112
n26	57	104	130	0.32	2.17	1566	128
n27	55	93	115	-0.63	1.12	1578	107
n28	50	94	113	-0.51	0.99	1521	133
n29	58	79	100	-1.89	0.01	1521	110
n30	57	60	75	-3.65	-1.80	1491	94
n31	54	48	60	-4.68	-2.98	1453	92
n32	50	84	101	-1.45	0.05	1557	102
n33	52	69	83	-2.84	-1.24	1502	102
n34	60	83	106	-1.58	0.42	1541	107
n35	53	70	81	-2.73	-1.48	1502	104

information for preventing osteoporosis is the other prong. Factors like race, body size, family history of osteoporosis and onset of menopause are the areas uncontrolled but intelligent decisions early in life can bear rich dividends later on.

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