11.24 Calcium Deficiency & Toxicity

Figure 11.241 Bone states; the width of each figure represents the bone mass. The height of the matrix and mineral boxes represents the relative proportion for matrix to mineral in the bone. Adapted from reference 3.

Osteomalacia - Bone mass is normal, but the matrix to mineral ratio is increased, meaning there is less mineral in the bone.

Osteopenia - Bone mass is decreased, but the matrix to mineral ratio is not altered from normal bone. This condition is intermediate in between normal and osteoporosis.

Osteoporosis - Bone mass is further decreased from osteopenia, but the matrix to mineral ratio is not altered from normal bone³.

The National Osteoporosis Foundation estimates that 10 million Americans aged 50 and above have osteoporosis, while 34 million have low bone mass. Together these 44 million Americans represent 55% of people aged 50 and above. Of the 10 million with osteoporosis, 80% are women⁴. To prevent osteoporosis it is important to build peak bone mass, 90% of which is built in girls by age 18 and age 20 in boys, but can continue to increase until age 30. After that time, bone mass starts to decrease. For women after menopause, this process dramatically increases because of the decrease in estrogen production, as shown in the link below⁵.

Web Link
Bone Mass

How do they measure people's bone mineral density? Dual energy X-ray absorptiometry (DEXA) accurately measures bone mineral density using a small amount of radiation. A DEXA is shown in the figure below.
A person lies down on the table and the arm of the machine moves slowly over them. From the scan, a bone mineral density t-score is generated. As shown below, normal bone mineral density has a t-score of greater than -1, osteopenia is from -1 to -2.5, and osteoporosis is a t-score of less than -2.5.

There are other methods of measuring bone mineral density, such as peripheral DEXA and ultrasound. These typically are done on the wrist or heel, but aren't as accurate because that one area might not reflect the bone mineral density in other parts of the body.

Calcium toxicity is rare, occurring in those with hyperparathyroidism or high calcium supplementation levels. Like vitamin D, toxicity can lead to calcification of soft tissues. In addition, a very high intake of calcium can lead to kidney stone formation.

References & Links
3. Sambrook, P. Bone structure and function in normal and disease states
   http://v5.books.elsevier.com/bookscat/samples/9780443070150/9780443070150.pdf

Links
Bone Mass - http://www.clarysageorganics.com/imgs/article/bone_mass_lc.gif