

BONE DENSITY BACKGROUNDER

Bone, composed primarily of the minerals calcium and phosphorus, is living tissue. Like other tissue in the body, it constantly replaces itself, a process known as bone remodeling. During the course of a year, between 10 and 30 percent of the skeleton is replaced. Small cells in the bone break down old bone, while other cells form new bone from protein, vitamins, and calcium. The most abundant mineral in the body, calcium is essential throughout one's life to build and maintain strong, healthy bones, and to maintain a wide variety of bodily activities.

Bone is the structural material of the body's skeleton. Each bone is comprised of two kinds of tissue: cortical bone and trabecular bone. Cortical bone tissue is the dense outer layer, while trabecular bone tissue is the "spongy", porous bone that makes up the interior. While every bone contains some of each type of tissue, bones differ in the proportion. For example, arm and leg bones are almost entirely composed of dense cortical tissue with spongy trabecular bone tissue only on the ends, while the 33 bones or vertebrae that compose the spinal column are primarily composed of trabecular bone tissue encased in a thin cortical shell.

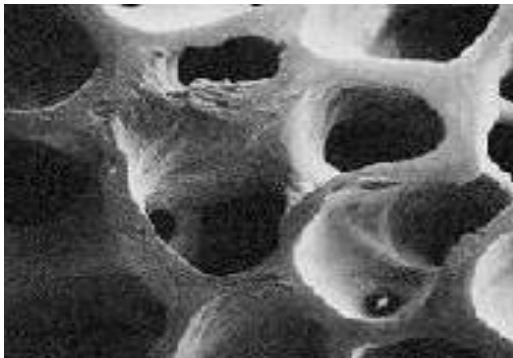
Bone remodeling occurs most rapidly in trabecular bone. Two types of bone cells carry out the remodeling process: osteoclasts and osteoblasts. Osteoclasts are responsible for resorbing, or breaking down the bone to form a pit-like depression on the bone surface. When this process is complete, the osteoblasts build the bone as new tissue, which is then deposited into the depressions.

Bone Remodeling Over the Years

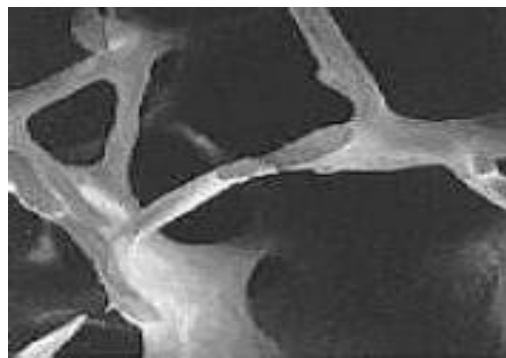
In early life, when bone growth is rapid, a well-nourished child will experience bone growth that is far more rapid than bone resorption. This is the period in life when high levels of calcium in the diet can do the most good because the conditions for storing the maximum amount of calcium within the growing bones are ideal. Such perfect conditions will never again occur in life.

At maturity, not everyone has the same amount of bone tissue. Girls have 20 percent less bone mass per pound of body weight than boys. Well-nourished, physically active children develop more bone mass than malnourished, diseased, or less active children. Black people have more bone mass than white or Asian people. The less bone mass people have early in life, the more likely it is that bone loss later in life will lead to osteoporosis.

Normally, peak bone mass is reached between 25 and 35 years of age. After 35, bone loss usually overtakes bone replacement, especially in trabecular bone. New tissue is not formed as quickly as old tissue is lost, and the total bone mass of the skeleton decreases. This begins between 35 and 40, and continues at a linear rate of approximately one percent per year. At first, the rate of loss between sexes is approximately the same. After menopause, women experience a definite acceleration of bone loss, rising to two to three percent annually. This occurs because the loss of estrogen leads to an increase in bone resorption, and inhibits efficient utilization of dietary calcium.



Normal Bone



Osteoporotic Bone

Measuring Bone Density

Measuring bone mineral density (BMD), the prime indicator of osteoporosis, can often be helpful in deciding whether to begin a program to prevent or treat osteoporosis, and can detect bone loss long before fractures actually occur.

According to the National Osteoporosis Foundations, BMD testing should be performed on:

- All postmenopausal women under age 65 who have one or more additional risk factors for osteoporotic fracture (besides menopause);
- All women aged 65 and older regardless of additional risk factors;
- Postmenopausal women who present with fractures (to confirm diagnosis and determine disease severity);
- Women who are considering therapy for osteoporosis, if BMD testing would facilitate the decision; and
- Women who have been on hormone replacement therapy for prolonged periods

BMD tests are reliable and painless and can usually be performed in less than 30 minutes. Tests include the OsteoGram, which measures bone density in the hand, dual energy x-ray absorptiometry (DEXA) bone density tests of the spine, hip, wrist or fingers, ultrasound tests of the heel, knee or leg, and quantitative computed tomography (QCT) tests of the spine. All of these tests have been shown to be good indicators of bone density and fracture risk throughout the body.

The OsteoGram, developed under grants from the National Institutes of Health and the National Science Foundation, is the simplest of these tests. It can be performed in less than five minutes in a physician's office by taking an x-ray of the hand. The film is then computer-analyzed in the physician's office to determine bone mineral density. The report compares the patient's bone density to normal and osteoporotic ranges. This information helps the physician determine the patient's risk for developing osteoporosis, and suffering future fractures of the hip, spine and other bones. It also enables physicians to monitor changes in bone density over time.