

### What is osteoporosis?

Osteoporosis refers to a condition in which the bones are less dense and more porous. This decrease in bone mass can result in bones that are fragile and have an increased risk of fracture. Osteopenia is a milder version of osteoporosis.

Bone is living tissue that is continuously being remodeled by the activity of two different kinds of cells, osteoblasts and osteoclasts. Osteoblasts build up the calcium and other minerals in the bone to make the bone strong and to repair fractures. The osteoclasts break down the old bone cells and release minerals into the circulation. The activity of the osteoblast and osteoclast cells is directed by hormones, chemical messengers, and the acid/base balance in the blood. In order to have healthy bones, there needs to be a balance of osteoclast and osteoblast activity. When bone resorption outstrips bone formation, there will be loss of bone mass.

Bone mass reaches its apex in the thirties and forties. Most of the population lose bone density with age. When women go through menopause, it is common to have an increase in the rate of bone loss for up to five years before it stabilizes.

Fractures related to bone loss most commonly occur in the hips, wrists, and spine. Nearly half a million people—particularly postmenopausal women and older men—take a fall each year that lands them in a hospital or nursing home with a broken hip, related at least in part to the effects of osteoporosis. One in four of these older people will die within the year following their fracture. Many of the others will eventually be confined to nursing homes for the rest of their lives. This is a heavy price to pay for a preventable problem.

Women are four times more likely to get osteoporosis than men because they have less bone mass to begin with, and, because of hormonal changes, they lose their bone density faster. The onset of osteoporosis in men is delayed about 10 years compared to women. Osteoporosis also occurs in men who have prematurely low levels of testosterone from testicular surgery, disease, and medications, including habitual use of marijuana. More than two million men in the US have osteoporosis.

### What causes osteoporosis?

Aside from the normal loss of density that comes with age, there are certain conditions that are associated with accelerated bone loss.

- 1) Sedentary life style
- 2) Family history of osteoporosis
- 3) Underweight, small bone structure, of Northern European ancestry
- 4) Prolonged use of steroids, such as prednisone
- 5) Hyperparathyroidism
- 6) Hyperthyroidism
- 7) Early menopause before age 45
- 8) Low testosterone levels in men
- 9) Cancer of the bone marrow
- 10) Vitamin D deficiency, low exposure to sunlight

- 11) High animal protein diet with low vegetable intake
- 12) Use of sodas and other carbonated drinks
- 13) High sugar and refined foods diet
- 14) Caffeine and alcohol
- 15) Cigarettes

### **How is osteoporosis measured?**

Years ago before there were bone density tests, the only time osteoporosis could be detected was after a bone was broken and the osteoporosis was significant enough to show up on a general x-ray.

Nowadays a bone mineral density test, called bone densitometry, can determine if you are at risk for developing osteoporosis. The bone density test most commonly used is a DEXA scan (Dual Energy X-ray Absorptiometry) which uses special low dose x-rays to measure how many grams of calcium and other minerals are packed into a segment of bone. The higher the mineral content of the bones, the more dense they are and less likely to break.

DEXA scans measure the bone density in the skeleton, usually at the hip and lumbar spine, and are the preferred method for diagnosing osteoporosis. During the test, the patient lies on a padded surface while a mechanical arm-like device passes over the body without touching it. The test does emit a small amount of radiation, usually about one tenth the dose of radiation received during a chest x-ray. The amount of x-ray that passes through the bone to the other side is measured and provides an accurate determination of the mineral content of the bone.

### Who should get tested?

The U. S. Preventive Services Task Force recommends bone density screening if:

- 1) You're a woman 65 or older
  
- 2) You're 60 and older and at increased risk for osteoporosis
  
- 3) You have a history of spontaneous, or low trauma fractures

Some women may decide to get the bone density testing at an earlier age, around the time of menopause, so that they can take preventive measures, should they be showing signs of osteopenia.

The optimal interval for repeat bone density testing, or the right age to stop testing, hasn't been determined yet. However, two or more years may be needed between tests to reliably measure a change in the bone density.

The effectiveness of treatment for osteoporosis is best monitored by measuring bone density when treatment begins and after two years of therapy. Bone density testing can also be used to monitor the effects of medical problems on bone health.

### **Interpretation of bone densitometry**

Bone density measurement can determine the presence and the severity of osteoporosis and can be used to predict the future risk of developing osteoporosis and fractures. The test results are expressed in two numbers: the T-scores and Z-scores.

The T-score compares your bone density with what is normally expected in a healthy young adult of the same gender. Your T-score is the number of standard deviations (SD) that your bone density is above or below the average. If your T-score is above -1, your bone density is considered normal. If your score is between -1 and -2.5, your score is a sign of osteopenia, a condition in which bone density is below normal and may lead to osteoporosis. Below -2.5, your bone density indicates you have osteoporosis.

The Z-score refers to the number of standard deviations above or below what's normally expected for someone of your age, gender, weight, and racial origin. A low Z-score of less than -2.0 suggests you might be losing bone more rapidly than expected for someone of your age, which might indicate another cause for the low bone mass besides normal aging. While bone density testing can tell you if you have low bone density, it can't tell you why. Your medical practitioner may recommend further testing to better understand why your bone mass is lower than expected.

### **Short-comings in bone density test interpretation**

The first bone mineral density test you get tells you the current density of your bones at that specific time. It cannot tell if you have lost bone or are currently losing bone. Low bone density

values do not necessarily mean that bone loss has occurred. They may be the result of a lower-than-average peak bone density, perhaps due to genetic inheritance. The only way to diagnose bone loss is to repeat the bone mineral density test in a couple of years to see if there is a progression of bone loss.

Another shortcoming of the test is the inability to measure the quality of the bone with our current technology. Bone quality plays an important role in determining bone strength. It is possible to have bones that are stronger, more resilient than would suggest from the bone density test results. And, conversely, it is possible to have dense bones that are brittle and fracture easily in spite of their density.

If you are 65 or older, it is not realistic to expect your bone mineral density T-score to be comparable to a young, healthy 20 year old. Having a T-score in the range of osteopenic is not something that necessarily requires treatment with pharmaceutical drugs, as long as there is no significant progression of bone loss seen in sequential testing.

### **What is the conventional treatment of osteoporosis?**

The standard recommendations for osteoporosis are 1200-1500 mg a day of dietary or supplemental calcium, vitamin D, weight bearing exercises, and prescription medication.

The medications reduce bone loss in two main ways: they lessen bone break down (anti-resorptive agents) or they stimulate the formation of new bone (anabolic agents). Patients are counseled to take the medication continuously. Bone loss resumes if the medications are stopped. The medications recommended include:

- 1) Hormone replacement therapy, (estrogen and/or progesterone)
  
- 2) Calcitonin
  
- 3) Bisphosphonates
  
- 4) Selective estrogen receptor modulators (SERMs)

Equine **estrogen** derived from pregnant mare's urine (Premarin) and synthetic **progesterone** (progestins) are commonly given for hormone replacement therapy and are approved for prevention and treatment of osteoporosis in women. This form of HRT may be associated with an increased risk of breast cancer, heart disease, or stroke according to the Women's Health Initiative trial. In a study published by the Journal of the AMA, (June 13

<sup>th</sup>, 2001) a review of 22 prior studies showed that standard hormone replacement therapy (Premarin & progestins) did not improve bone density.

**Calcitonin** is a hormone that the human body makes in a portion of the thyroid gland, unrelated to thyroid hormone. It slows the break down of bone. Supplemental calcitonin (Miacalcin, Fortical) comes as an injection or a nasal spray that is approved for treatment of osteoporosis in men and women. Calcitonin supplements may be obtained from natural sources such as salmon, or they may be made synthetically. Although calcitonin is considered safe, it may not be as effective as other treatments for osteoporosis.

**Bisphosphonates** (Fosamax, Actonel, Boniva) are a group of drugs that attach to the calcium in the bone and decrease the activity of the osteoclasts, the cells which break down and remove old bones cells. It is theoretically possible, although unproven, that, with the osteoclast activity impeded by the biphosphonate medication, the bones will get more brittle even though they are becoming more dense.

Bisphosphonates are administered in various dosing regiments including daily, weekly, twice monthly, monthly and every three months. Zolendronic acid (Reclast) is the newest

bisphosphonate and is available as an injection given only once per year.

Bisphosphonates can cause inflammation of the eyes, upset stomach, heartburn, esophageal ulceration, diarrhea, and bone and muscle pain. In rare cases, bisphosphonates can cause osteonecrosis of the jaw, a very painful condition in which a portion of the jaw bone dies. Osteonecrosis occurs mainly in those who have undergone dental surgery while on the medication.

**Selective estrogen receptor modulators** (Evista) is a category of oral medication for women who are post-menopausal and who are not taking hormone replacement therapy. SERMs attach to the sites on cells where estrogen usually attaches. This results in a decrease in bone break down. SERMs act like estrogen in some parts of the body.

Since SERMs are relatives of estrogen, they may result in an increase in hot flashes and an increased incidence of blood clots.

### **An alternative, non-pharmaceutical approach to osteoporosis prevention and treatment**

The key to osteoporosis is prevention. If you build up the density of your bones before menopause, you will be able to spare loss of calcium from your bones later in life without endangering yourself. But, it's never too late to begin rebuilding bones.

The first place to begin a comprehensive evaluation of a person who either has osteoporosis---or who wants to prevent it---is to try and determine some of the factors that might contribute to the condition. Questions that I ask my patients:

- How old are you?
- When did you go into menopause?
- Is there a history of osteoporosis in your family? Did your mother have a history of fractures as she aged? Did she have a “dowager’s hump?”
- How much exercise do you get? What kind of exercise? Does this include any weight bearing exercises?
- Do you have any chronic medical conditions? Rheumatoid arthritis? Kidney failure? Diabetes?
- Have you had any surgeries?
- Do you have any digestive problems or inflammatory bowel conditions? Celiac disease? Crohn’s disease? Ulcerative colitis?
- What medications are you on? Thyroid? Steroids? Female hormones? Acid blockers? Pain killers? Anti-depressants?
- Do you smoke or drink alcohol?
- How much caffeine do you drink?
- Do you drink sodas?
- What do you eat in a typical day? How much are sugar and refined foods part of your life?
- How much animal food do you eat on average a day (dairy, meat, eggs)?
- How many vegetables do you eat on an average day?
- What vitamins and mineral supplements do you take?

The most common causes for abnormal bone loss are related to diet and lack of exercise.

### Diet

The standard American diet is highly acidifying which causes minerals to dissolve from the bone, which, in turn, promotes accelerated bone loss. A typical meal consists of high animal protein from meat, poultry, eggs, and dairy products (milk, ice cream, cheese, yogurt), with few vegetables, sugary and highly refined foods, caffeine, alcohol, sodas and other carbonated drinks, all of which are acidifying to the blood. The body operates optimally in a narrow pH range. An acidic condition in the blood—as distinguished from the acid in the stomach which is necessary for proper digestion—is not conducive to good health, increases susceptibility to

illness, and accelerates aging and degeneration. In order to neutralize the acidity in the blood, the body mobilizes minerals from the bones, such as calcium and magnesium, which buffers the acidic molecules and makes them more alkaline.

The consumption of dairy products is commonly encouraged by conventional nutritionists in order to “build strong bones and teeth.” While dairy does indeed contain very high amounts of calcium, it is a myth that it produces strong bones. The calcium in the dairy products is not well utilized because much of it is used to neutralize the acidity from the animal protein, which results in a net loss of calcium. Over time, the loss can be significant. In addition, animal foods, along with sodas, contain high amounts of phosphorous which interfere with calcium absorption from the intestines.

It is interesting to note that, until recently when western diets were introduced, the countries with the lowest rates of osteoporosis were in Asia where dairy was rarely consumed. And the highest rates of osteoporosis are found in the United States and Europe, both high dairy consumers. In addition, most of the world’s population does not take calcium supplements yet still has strong and healthy bones.

In my medical practice, I encourage a diet that contains a large variety and quantity of vegetables, which are rich in minerals and also help to alkalize the blood. I suggest eating a high intake of non-dairy, calcium-rich food such as kale, chard, broccoli, mustard greens, bok choy, wild Alaska salmon, sardines, spinach, sesame seeds, nuts and seeds, and seaweed. Dairy products, contrary to prevailing wisdom, are discouraged. And meat is suggested in moderation (4-6 oz a day) for the non vegetarians, balanced with plenty of vegetables to maintain the acid/base balance. The ideal diet contains primarily unrefined foods, with limited intake of foods made of flour and sugar. Instead of coffee, which leaches calcium from the bones, I suggest green tea or other herbal teas. Instead of milk, there are lots of tasty substitutes that can be used, such as coconut milk, almond and hazelnut milk, and rice milk. Instead of sodas, one can squeeze a lemon or a lime in filtered water. Regular use of carbonation should be avoided, as well as alcohol, both of which leach calcium from the bones.

Cigarette smoking is strongly discouraged. Smokers have twice the rate of hip fractures as non smokers.

## Testing

Tests I commonly order in patients with unexplained osteoporosis are TSH to check for hyperthyroidism which can accelerate bone loss, PTH to check for elevated parathyroid hormone which can increase calcium removal from the bones, vitamin D, and B-12 levels. If there is any evidence of bowel or digestive problems, I evaluate for parasites, occult food allergies, celiac disease (gluten allergy), and inflammatory bowel problems like crohn's disease or ulcerative colitis.

If money is not an issue, it is a good idea to check the patient's **red blood cell mineral** levels (Metamatrix or Genova Diagnostic Lab)—

**not**

the serum levels which is commonly done at standard labs and is not very meaningful. The results of the RBC mineral testing commonly show low mineral levels.

Hormones are routinely checked by either saliva or 24-hour urine test from Meridian Valley Labs.

## Supplements

Bones are made up of many minerals such as boron, silica, and magnesium---not exclusively calcium. Mineral deficiency is a common problem. The mineral content of our foods has diminished over the last several decades due to our farming practices. For absorption to take place, minerals require adequate stomach acids in order to dissolve. It is common, as we age, to have increasingly lower levels of acid in the stomach, so that digestion becomes more problematic. In patients over 50, in the absence of hyperacidity, I suggest taking with each meal **digestive enzymes** that include hydrochloric acid, which will help in the absorption of minerals. I also suggest taking a **trace mineral supplement** with the digestive enzyme at mealtime. Make sure your supplement is free of trace amounts of heavy metals, often found in minerals from the sea.

Acid blockers, commonly prescribed by mainstream doctors, make the problem of mineral deficiency even more pronounced. If a patient has been using acid blockers for reflux or gastritis, then, over time, they are at an even higher risk of bone loss. Minerals require an acidic environment in the stomach in order to be extracted from the foods and dissolved in solution for absorption to take place. So, in order to treat osteoporosis, we must first address any underlying digestive disorders so that the stomach and esophagus can heal and the patient can gradually be weaned off the acid blockers, if possible. (See chapter on reflux/gastritis/ulcers)

**Magnesium** is essential to bone health, even more important than calcium, according to some experts. But most Americans are deficient in this important mineral. Magnesium regulates the transport of calcium into the cells. Deficiency in magnesium is a significant risk factor for osteoporosis. Magnesium supplements are hard to absorb and often cause diarrhea. The most absorbable kinds are magnesium citrate, aspartate, and glycinate. The amount to take can range from 400-800 mg per day.

**Calcium** supplements are also poorly absorbed. Calcium citrate is probably the best absorbed out of the various options recommended. Food-based calcium supplements derived from seaweed are well absorbed but not widely available. I suggest to my patients that they rely more heavily on getting their calcium from non-dairy, calcium-rich plant sources than from their calcium supplements.

The conventional medical approach is to recommend high doses of calcium, between 1,000 and 1500 mg a day for adults. However, this blanket recommendation is based on the typical American diet---high in animal protein and refined foods and low in vegetables. And it assumes inadequate levels of vitamin D. If a person is consuming a high vegetable, non-dairy, calcium-rich diet with a minimum of refined foods, then significantly less calcium is needed. And if the source of the calcium supplements is highly absorbable, such as that derived from seaweed, then only one third of the recommended dose is needed.

Excess calcium intake from supplements, especially when not balanced by adequate intake of magnesium, can result in calcium deposits in the soft tissues, including the aortic vessels. Many experts are saying that the ratio of magnesium to calcium needs to be in the range of 1:1. However, if more than 800 mg of magnesium is taken, it frequently results in diarrhea. Excess calcium can also inhibit absorption of trace minerals, such as boron, zinc, and copper, all of which are important in bone formation.

When buying supplements, remember that capsules have more chance of absorption than tablets, which can pass right through the digestive tract intact.

**Vitamin D**, or calciferol, facilitates calcium absorption from the intestines, among its many benefits. Insufficient vitamin D can lead to accelerated bone loss. Now that Americans are doing such a good job of staying out of the sun, we are becoming increasingly more vitamin D deficient. Depending on the latitude you live at, the rays of the sun only cause our bodies to produce vitamin D during the warm months, from late spring to early fall, when the sun is at a certain angle. During those months, I encourage my patients to expose themselves to the ultra-violet light, without sunscreen, for just a few minutes each day on their front and backs while they are in their bathing suits, with their faces covered. In the winter, patients are encouraged to take supplemental **vitamin D3**, around 2000 IUs.

**Vitamin K** is most known for its role in blood clotting, but it plays an essential role in bone formation and bone health. There are three types of vitamin K. K1 (phylloquinone) is found in green, leafy vegetables such as spinach, kale, collard greens, and broccoli. K2 (menaquinone) is produced by the beneficial bacteria in our intestines. K3 (menadione) is a synthetic version made in a lab and not recommended. The recommended dose is a combination of K1 and K2, 1 mg a day. (Anyone on blood thinners should not take vitamin K.)

**Strontium** has been shown to play a significant role in preventing and reversing osteoporosis. This essential element is often confused with strontium-90, a very dangerous, radioactive form of strontium produced during nuclear fallouts. Elemental strontium is non radioactive and non toxic and safe even when given over long periods of time at large doses. Because it has properties that are similar to calcium, strontium accumulates in the bones and adds strength to them. Since strontium and calcium are thought to compete with each other for uptake into the bones, it is suggested that the two supplements be taken at different times of the day, one in the morning and the other in the evening, for example.

Other supplements involved in bone health include **silica**, **omega 3 fish oils**, **sub-lingual methylcobalamin** (B-12), **alpha lipoic acid** and **n-acetyl cysteine** which inhibit osteoclast function, and

### **lactoferrin**

which stimulates the DNA in osteoblasts, the cells involved in bone formation.

### **Hormones**

The topic of hormones is controversial. I tend to use hormones only if the patient is symptomatic from menopause and/or has osteoporosis. The hormones I use in my practice are bio-identical, which means they are the same hormones our bodies make. I do not prescribe Premarin or progestins (synthetic progesterone) in my practice. I use only the smallest amount of bio-identical hormones that brings relief to the patient. Progesterone is the hormone added first. Estrogen is only added if the patient continues to have symptoms, and then, in only miniscule amounts. (refer to chapter on hormones.) Natural progesterone (not to be confused with Provera, the synthetic version of progesterone) has been shown to increase bone density by promoting the growth of osteoblasts, the bone forming cells. At around age 35, women's progesterone levels drop dramatically in relation to their estrogen. This, in turn, creates a condition known as estrogen dominance. Some experts believe that the drop in progesterone has far more influence on triggering bone loss than decline in estrogen.

### **Exercise**

The more bone mass you build before age 25 or 30, the better off you will be during the years of gradual bone loss. Exercise can also help you maintain bone density later in life. But it's never too late to start an exercise program. Even adults over 80 who begin a regular weight-bearing exercise program can increase their bone density.

No matter how well you eat, no matter how many supplements with calcium you take, inactivity can result in rapid bone loss. At my medical school, athletes from the football team volunteered to be guinea pigs in an experiment to determine how soon bone loss occurs after becoming

inactive. They were asked to remain in bed for three days. During that time the volunteers' urine was tested for substances that are released from the bone when there is bone turnover. Judging from the results, bone loss began after the first day of bed rest. The good news is that the bone turnover stopped immediately after the volunteers were back to their active selves on the football field and were soon able to recoup their losses.

Exercise is absolutely crucial to prevent bone loss. Bone is living tissue that responds to stimuli. When the muscles contract, they pull on the tendons, which in turn pull at their attachment to the bone. This pull sends a signal to the brain to leave the calcium on the bone and causes the bone to become stronger. The fastest non-pharmaceutical way to increase bone density is to do aerobic exercises, weight lifting, and resistance training. Some of the many possibilities are walking up hills, hiking with a pack, lifting weights, dancing, biking, jogging and other sports that work against gravity. Swimming and simply walking on flat terrain, although good for cardiovascular fitness, are not the best exercises for building bone mass. Thirty minutes of weight-bearing exercise daily benefits your bones, as well as your general well being. Some of my patients are severely limited in what they can do for lack of time. For those people, I suggest they get graduated weights from the sporting goods store and wear them around their ankles, waist, and wrists while they are doing their normal activities.

Some people who already have osteoporosis wonder whether they should exercise at all. The answer for most people is a resounding YES. The exercises need to be ones that minimize the chance of tripping and falling and need to be increased gradually.

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