Rise up with *Pro Osteo*

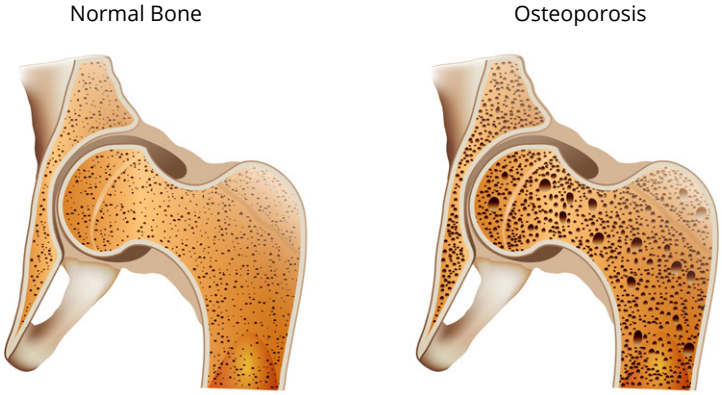
Bone health is something people often neglect until later in life. At that point, individuals are usually well past the age of peak bone mass and have reached the phase where bone density begins to decline. This starts at age 30 in both men and women. There are certain factors that can make one more susceptible to bone density issues: early menopause, smoker, over 65, under 132 lbs, heavy alcohol consumption, low testosterone, rheumatoid arthritis, celiac disease, gastric bypass surgery, chronic obstructive pulmonary disease, corticosteroids and genetics.

Before discussing what we can do to maintain healthy bones, it is important to understand more about what bone is comprised of and the cycles it undergoes. **Ninety percent of bone mass is collagen**, which provides form and flexibility. The minerals calcium, phosphorous, magnesium and manganese are important components that provide both strength and density. Bone, like the rest of our body, is living tissue that is constantly undergoing change and repair. Approximately 15% of bone undergoes turn over per year. Osteoclasts and osteoblasts can be thought of as the bone maintenance crew. Osteoclasts are responsible for the daily removal of small amounts of bone mineral and osteoblasts are responsible for the daily deposition of bone minerals and creation of new bone. Bone density decline arises when the resorption of bone by osteoclasts occurs faster than bone deposition. **Menopause, as well as age, unfortunately speeds this process and by age 50, one in four Canadian women will have osteoporosis. By age 70, many will have lost up to 50% of their peak bone mass. This may sound like a hopeless scenario, however, there are things that can be done to slow bone density decline.**

If you are still young or you have children, start thinking about bone health now. It is during these years that peak bone density is reached and this is influenced by genetics as well as lifestyle and nutrition choices. It is estimated that a 10% increase in bone density in children translates to a 50% reduction of fracture risk due to osteoporosis later in life. Inversely, poor diet and lack of exercise, particularly between the ages of 10-18, results in an increased risk of osteopenia and osteoporosis. A study has shown that girls who participate in regular physical activity gain approximately 40% more bone mass than those who are inactive.

If you are like the majority of people who do not start to consider bone health until later in life, it is not too late. There are many things that can be done to control the rate at which bone density declines. Firstly, diet and lifestyle choices are important. One should avoid smoking and heavy alcohol consumption. Physical activity is still necessary for healthy bone maintenance in adults, particularly participation in regular weight bearing activity. It is also a good idea to use a supplement that provides adequate doses of calcium, vitamin D and other cofactors that are required for bone health. The following are some of the top nutrients for maintaining

Osteoporosis comparison



bone density and preventing fractures due to osteopenia and osteoporosis

Collagen

Collagen is the most abundant protein in the body and is responsible for 90% of bone mass. A study of oophorectomized mice (ovaries removed to produce hormone related bone density decline similar to that observed in menopausal women) found that daily intake of hydrolyzed collagen resulted in equal bone restoration to the control group as well as increased size and strength of bone. Hydrolyzed collagen has also been shown to induce osteoblast (responsible for bone formation) activity and reduce that of osteoclasts (responsible for bone resorption).

"We tend to think of bone in terms of stiff ceramic-like structure," said researcher C. Mauli Agrawal. "But bone is a mixture of mineral and collagen. The ability of bone to sustain a sudden blow could be related as much to the protein content of the bone as to the amount of bone mineral."

Unfortunately, collagen production declines with age. The most obvious signs of collagen decline are the wrinkling of skin and more rigid joints. However, decreased bone density is also a result of reduced collagen production. Therefore, it is important to look for a bone formula that not only contains the vitamins and minerals required for bone health but also a highly bioavailable form of hydrolyzed collagen.

Calcium

Calcium is the most well known nutrient for bone health. The body cannot synthesize calcium so it must be obtained through the diet. Good sources of calcium include dark leafy greens like: collard greens, broccoli, kale, soy beans (non gmo) and bok choy. Eight ounces of collard greens contains almost 1/3 more calcium than an eight ounce glass of milk. As much as the dairy industry would like to have you believe that you will not grow up to have strong bones unless you drink milk, hip fractures occur at higher rates in the countries with the highest dairy consumption. A study of approximately 80,000 women found that those who drank two or more glasses of milk per day had almost two times the rate of hip fracture compared to women who rarely drank milk.

Calcium has recently gained some attention in the media due to a study that connected high dose calcium with an increase in cardiovascular events. When listening to these findings, it should be considered that the results were from studies where subjects were taking calcium alone, without any of the important co-factors that are necessary for absorption. It is also know that not all calcium types are easily absorbed. Calcium carbonate is the least absorbable form of calcium.

Considering we only absorb less than half the calcium we ingest from our food, it is important, particularly for those that are at risk for bone density issues, to add a calcium supplement containing the cofactors necessary for absorption to one's regimen. The recommended dosage is 1200mg/day.

Magnesium

Magnesium is as important for bone health as calcium. Many people are aware of the importance of vitamin D for bone health, however, without magnesium vitamin D cannot be converted into its active form, which is essential for initiating calcium absorption.

All of the enzymes that metabolize vitamin D are magnesium dependent. For people who are taking very high doses of vitamin D, it is important to make sure you are also supplementing with magnesium or your body will begin to draw the magnesium required to activate vitamin D from your muscles. This leads to commonly seen symptoms of magnesium deficiency like: muscle cramping, restless legs and twitching. The heart is the most important muscle in the body and can also produce symptoms of magnesium deficiency like: angina, high blood pressure and even heart attacks. If you are taking 1000-2000 IU of vitamin D, it is advised to supplement with approximately 600mg of elemental magnesium.

Magnesium stimulates calcitonin. Calcitonin is a hormone that draws calcium from the blood and other tissues into bone. Magnesium also keeps calcium dissolved in the blood. Without magnesium present one might develop calcification in areas of the body where it could cause problems like: arteries, kidneys, gall bladder, muscles and breast tissue. In the study recently linking calcium supplementation to increased cardiovascular risk, it is not simply a matter of too much calcium but also a lack of magnesium. It is very important to understand that magnesium is as essential in a supplement for bone health as calcium.

Vitamin D

As discussed above, vitamin D is necessary for initiating calcium absorption. Vitamin D is not actually a vitamin. Vitamins are essential nutrients that the body cannot produce and that we must obtain through diet or supplementation. Vitamin D can be obtained through diet; however, it is also produced by the kidneys from a cholesterol precursor and is actually considered a hormone. The biologically active form of vitamin D is calcitriol or vitamin D3. In the intestines, vitamin D3 activates calcium-transporting proteins. These proteins carry calcium through the intestinal walls into the blood. Without vitamin D, dietary or supplemental calcium could not make it from the gut into circulation and ultimately to the bones.

Vitamin K2

Vitamin K2, known as menaquinone, is an essential in a good bone supplement. Menaquinone is made by bacteria in the gut and goes directly to blood vessels, bones and tissues other than the liver. Aside from the role Vitamin K2 plays in bone health, it is also important for removing and preventing calcium accumulation in the blood vessels as well as other soft tissues. When choosing a supplement that contains vitamin K2 it is important to ensure that it is in the longer chain form MK-7 and not MK-4, as this shorter chain form is derived from synthetic sources in supplements. MK-7 is derived from a bacterial fermentation process.

Vitamin K2 and vitamin D work hand in hand. When we supplement with vitamin D, proteins that move calcium around the body are created. These proteins are vitamin K2 dependent for activation. Essentially, without the vitamin K2 the calcium cannot be shuttled to the parts of the body where it is required. If calcium is not shuttled to the parts of the body where it belongs, the result can be the accumulation of calcium in areas where it can cause harm, like the blood vessels. Just like with Magnesium, if you are taking supplemental vitamin D, it is very important to also take Vitamin K2. If one is taking particularly high doses of vitamin D, it is important that one increase both supplemental magnesium and vitamin K2. Aside from shuttling calcium in the body, Vitamin K2 has also been

shown to increase osteoblast activity, cells responsible for bone formation, and reduce osteoclast activity, cells that are responsible for bone resorption.

Silicon

Silicon is the most ubiquitous of all trace elements and is found in the blood at levels similar to elements like iron, copper and zinc, whose physiological importance is well known. Research has shown a correlation between dietary intake of Silicon and the health of bone and all connective tissue in general. The exact mechanism of action is not completely clear; however, the hypotheses are the role of silicon as a cofactor in collagen production and/or its stabilization, and bone matrix mineralization (deposition of minerals in bone). In animal studies it has been shown that a deficiency in silicon leads to connective and skeletal tissue defects. It has also been found that silicon is concentrated at the site of mineralization of growing bone and that silicon intake is associated with increased bone density.

Boron

This is a trace mineral that is also essential for bone building. A study by the US Department of Agriculture found that post-menopausal women who took 3mg of Boron per day excreted 44% less calcium in their urine. Studies have also found that bones of those supplementing with boron are much stronger and harder to cut. Boron plays an important role in the metabolism of the bone building minerals calcium and magnesium. It can also help to improve estrogen production in menopausal women and reduce some of the symptoms of menopause, ultimately preventing the need for hormone replacement therapy. Some food sources of boron include: grapes, cherries, avocado, peanuts, almonds, hazelnuts, scallops, mussels and clams.

Zinc

Zinc is an essential trace element required for bone formation. The major role it seems to play in bone formation is through the effect it has on osteoblasts (cells responsible for bone formation). Studies have found that osteoblasts exposed to zinc seem to have increased alkaline phosphatase (ALP) activity, a protein involved in the elaboration of the bone matrix. Zinc also helps to increase collagen concentration and this is found to occur within one day of cellular exposure with the stimulatory effects increasing over time. Further, it helps to increase the proliferation of osteoblasts from stem cells. Low levels of zinc, especially during periods of development like adolescence, have been correlated with weak bones. Food sources of zinc include meat, beans, nuts and oysters.

As you can see there is far more to bone maintenance than just calcium. There are so many important cofactors required to ensure that our bones get all of the nutrients required. When choosing a bone supplement, make sure you choose one that contains all of the compounds discussed to make sure you are optimizing the effects of each of the individual ingredients. No matter what age you are, bone health is something that should not be neglected. Preventing fractures could save your life.

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