Roundoc Rx

Natural Approaches to Preventing and Managing Osteoporosis

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Osteoporosis is the state of decreased bodily bone mass that now affects about 10 million Americans.[1,2] When viewed through a microscope, bone normally resembles a honeycomb, with holes and spaces surrounded by a solid network of solid crosslinks and fibers. In osteoporosis, the holes and spaces are enlarged and the solid network of bone occupies much less of the viewed area. The loss of bone mass in osteoporosis corresponds to a loss of bone mineral density (BMD), or the amount of mineral matter per square centimeter of bone, which, in turn, accords with a loss of bone strength.

Diagnosis

Osteoporosis is most commonly diagnosed on the basis of an individual's "T score," or BMD at a particular site in the body, which is usually measured with dual-energy X-ray absorptiometry (DEXA). The T score derived from a DEXA scan compares an individual's BMD with a standardized normal value for a young, healthy individual. The World Health Organization defines osteoporosis as a BMD of the hip bone that is 2.5 standard deviations or more below the peak hip-bone density of such a healthy individual.[3,4]

However, the concern with osteoporosis is not so much the decreased bone mass it involves as the increased risk of bone fracture that accompanies it.[5] On a worldwide scale, an estimated 9,000,000 osteoporotic fractures occurred in the year 2000, with fractures of the hip, forearm, and spine being the most common.[6] The consequences of such fractures include chronic pain, depression, loss of mobility and independence, and an overall increase in mortality.[7–9]

Pathophysiology

In terms of basic pathophysiology, osteoporosis is a condition in which osteoclasts—the cells that break down and resorb bone—are more active and exert a greater effect than the osteoblastic cells that build bone. As a result, anything that promotes the activity of osteoclasts or interferes with the activity of osteoblasts can retard bone growth and strength and, over a longer period, can result in osteoporosis or the less-severe osteopenia, which can be a precursor to osteoporosis. High among the various factors regulating bone growth and breakdown are the hormones estrogen and testosterone, with estrogen and its metabolites performing most of this function. In both female and male adults, estrogen is particularly important for maintenance of trabecular bone mass and structure, while testosterone stimulates periosteal growth. In addition to being a precursor to bone-building estrogen via aromatization, testosterone also helps build muscle mass, which can prevent fractures related to falls.[10]

Because estrogen supports osteoblastic activity and helps build BMD, especially in younger women, this hormone's declining secretion at menopause is a key factor in the wide prevalence of osteoporosis during and after this phase of life.[11] With the onset of menopause, the body's production of estrogen declines, with a corresponding decline in the activity of osteoblasts accompanied by the continuing activity of osteoclasts that results in a net loss of bone density. Because of this, the U.S. Preventive Services Task Force recommends DEXA or other screening for osteoporosis in women older than 65, and suggests that screening may be important for men over age 70, who also experience a decline in both testosterone and estrogen levels.[12,13] I routinely recommend that my female patients

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begin to get sequential DEXA scans, starting at about the time of menopause. I do this specifically for women who tell me that they're having hot flashes and dryness and want to know their bone density to ascertain whether hormone replacement therapy (HRT) or a comparable regimen of nutraceuticals and a vigorous exercise program might be appropriate for them.

The mainstream medical approach to postmenopausal osteoporosis in women has often been an automatic recommendation to start estrogen replacement therapy (ERT) when the DEXA scan shows osteoporosis or osteopenia. It is true that the data for using such therapy at menopause are strongly supportive for such therapy staving off osteoporosis. However, there are numerous downsides to long-term use of estrogens. I am particularly concerned that, in a subset of genetically prone women, HRT with estrogen—especially with conjugated equine estrogens, but also "bioidentical" estrogens such as 17-β estradiol or estrone—can produce genotoxic metabolites that may increase the risk of breast cancer or other cancers. A genotoxic effect has particularly been found for the 4-hydroxy catechol metabolites of estradiol. These 4-hydroxy catechol estrogens are highly susceptible to being oxidized into quinone and semiquinone derivatives that interact with DNA to form depurinating adducts. The resulting DNA damage can lead to cellular transformation and the development of cancer.[14,15]

Moreover, the use of ERT has become increasingly problematic in view of the findings associating it with the risk of heart disease, stroke, and cancer in the Women's Health Initiative and other studies.[16–18] I have an increasing number of postmenopausal patients who simply do not want to increase their risk of developing heart disease or stroke or cancer with such therapy and, for that reason, do not want to take hormones of any kind, whether or not they are bioidentical. Additional conventional approaches are discussed later in this article.

Risk Factors

Use of Corticosteroids

In addition to a deficiency of calcium and other nutrients, there are a number of factors that can lead to osteoporosis. One of the most important of these is the prolonged use of corticosteroids for treating inflammatory conditions.[19–21] As much as 20% of the body's bone may be lost in the first year of chronic use of corticosteroids, and as many as half of people taking corticosteroids for more than 6 months may experience fractures.[22] Anyone taking corticosteroids long-term needs to have regular DEXA scans to monitor bone density.

Alcohol

Excessive consumption of alcohol is a major risk factor for osteoporosis. A meta-analysis of alcohol consumption's effect on hip-fracture risk and on bone density concluded that, compared with abstinence, having 1 drink per day reduces the risk of both of these outcomes, while more than 2 drinks per day raises the risk of both outcomes significantly.[23] Other studies have found osteoporosis in as many as 52% of persons who abuse alcohol and an association between chronic use of alcohol and decreased BMD in the femur and lumbar spine.[24] We still don't know what constitutes "excessive alcohol" in terms of osteoporosis but, in the absence of specific evidence, I usually recommend not having more than 1 or 2 glasses of wine or beer per day.

Cigarette Smoking

Cigarette smoke dramatically increases oxidative stress and inflammation, both of which contribute to the pathophysiology of osteoporosis. Smoking has been found to reduce BMD and bone mass, possibly by inhibiting the activity of osteoblasts[25–29]; increase the breakdown of exogenous estrogen; promote earlier menopause; and reduce body weight.[30] Many studies have identified smoking as an independent risk factor for osteoporosis.[30] Although smoking rates have been dropping considerably in the developed world, they have continued to rise in developing nations. Current estimates are that there are more than 1.1 billion smokers around the world, so this continues to be a big problem.

Caffeine

Although the data regarding the effects of caffeine on bone density are conflicting, at least one study found that elderly postmenopausal women who consumed more than 300 mg of caffeine per day (3 cups of coffee) had accelerated bone loss of the spine.[31] To stay on the safe side, I recommend keeping coffee intake at 1 or 2 eight-oz cups per day for individuals who are at risk for osteoporosis.

Acidic Diet

One strategy that I consider reasonable and protective against osteoporosis is consuming an alkaline diet. Increasing evidence implicates the Western diet, through its excessive acid content, as a risk factor for osteoporosis. This situation has been described as a chronic low-grade metabolic acidosis.[32] If one's diet imposes a high acid load, the body has to do a lot of buffering to maintain a normal blood pH. Calcium is one of the primary substances the body uses for that buffering, with bones being the primary reservoir. By contrast, vegetables and fruits, which contain substantial quantities of bicarbonate, citrate, and potassium, tend to neutralize acidity and have been shown to produce more alkaline urine.[32,33] Numerous studies have shown that diets abundant in fruits and vegetables are positively associated with bone health.[34]

Carbonated Beverages

Cola beverages and other carbonated soft drinks are also acidic (with a typical pH of 2.5–5), largely because of their content of phosphoric and carbonic acids. A high intake of such beverages, particularly colas, may also increase the acid load on the body and have an adverse effect on bone.[33,35] By comparison, sparkling mineral water, has a pH of ~ 6, which is much closer to that of tap water (with a typical pH of 7). Consuming mineral water may be an easy and inexpensive way of helping to prevent bone loss and osteoporosis.[32] Many people

already prefer mineral water to colas and other sweetened sodas because they help people to feel full and keep their weight down. What is even better, especially from the standpoint of warding off osteoporosis, is to drink sparkling mineral water that contains calcium and magnesium.

Celiac Disease

Celiac disease, for which there is good evidence as a cause of reduced BMD, is a common and overlooked cause of osteoporosis.[36] In one study of 55 men and women treated with a gluten-free diet for celiac disease, osteoporosis was found in 50% of the men and 47% of the women.[37] This is presumably because of malabsorption from damaged intestinal villi, although adoption of gluten-free diets are often not sufficient to normalize bone mass.[38] I have seen osteoporosis in both men and women who had no gastrointestinal (GI) symptoms or other overt indications of celiac disease but in whom testing revealed positive antibodies to gliadin and/or tissue transglutaminase.

Lead and Cadmium

Among other less well-recognized sources of potential risk are lead and cadmium, which belong to the category of toxic metals. Both lead and cadmium, as well as other metals in this category, can enter the body occupationally and from polluted air and water, impairing bone structure and increasing the risk of fracture and osteoporosis.[39] Because of this, and because of the toxicity of lead and cadmium, it is important to measure their concentrations in the blood in people who have been diagnosed with osteoporosis. In addition, the bone loss that occurs with menopause can liberate lead that has been sequestered in bone since childhood.[40] This can increase blood lead levels, which contributes to a vicious cycle of ever more increasing bone loss.

Additional Conventional Prevention and Treatment Approaches

Exercise

High-impact exercise is at the top of everyone's list for preventing osteoporosis. Walking, running, or jumping, increases the pull of gravity on the bones, which is essential for building bone mass. Studies have found that aerobic, weight-bearing, and resistance exercises maintain or increase BMD in postmenopausal women,[41] and weight-bearing endurance exercises or muscle-strengthening exercises have been shown to improve bone strength in persons with osteoporosis.[42]

For patients who can do it, I recommend jumping up and down on a mini-trampoline for 20 minutes per day, four or five times per week. This gentle exercise greatly increases the gravitational pull on the bones. Swimming is a wonderful form of exercise that I highly recommend for cardiovascular health but, because of the buoyancy of water and absence of the need to use muscles to counteract gravity, swimming does not put any stress on the bones and does little to increase bone density.

Weight-lifting is excellent for building bone. It increases the traction that the muscles exert on bone, which helps the bone to develop an electromagnetic field. That happens because bone is a crystalline material and its crystals are piezoelectric: When compressed, such as by the muscle traction used in weight-lifting, they generate an electromagnetic field.[43,44] Research suggests that this electromagnetism increases bone formation and accelerates bone repair. Electrical stimulation is now used as a medical technique for promoting bone union in fractures that otherwise fail to heal.[45]

Stress Management

The impact of excessive stress should be considered for managing osteoporosis. When there is enough ongoing stress to raise a patient's blood cortisol levels and keep them high, the effect resembles what happens with the prolonged use of exogenous corticosteroids: The stress leaches calcium from the bones. Stress is an inescapable part of living, so it can't really be avoided, but one can recommend that people use stress-management techniques to track levels of stress and find healthy ways to cope when it becomes excessive.

Bisphosphonates

Like anything in medicine, choosing from among the different potential interventions for osteoporosis is never as simple as one would like it to be. The standard recommendation is for calcium and vitamin D, which have clear benefits when used sensibly. For patients who require medical treatment for osteoporosis, the mainstream approach is estrogen replacement, as mentioned earlier, with its risks and benefits, often accompanied by a bisphosphonate drug.

I do sometimes prescribe bisphosphonates, such as alendronate and risedronate, for a number of years for certain patients who have advanced or persistent osteoporosis, or breast cancer that has metastasized to bone. Bisphosphonates inhibit bone resorption by interfering with the activity of osteoclasts.[46] The U.S. Food and Drug Administration requires that the labeling for bisphosphonates specifies that they be used only after calcium or vitamin D deficiency or both have been corrected.[1,47]

However, bisphosphonates can cause significant side-effects, such as GI reflux, heartburn, and atrial fibrillation. For this reason, many women can't tolerate bisphosphonates—not even with once-monthly dosing. What is of greater concern is that bisphosphonates can sometimes cause osteonecrosis of the jaw, with a serious chronic loss of bone. This sequela commonly develops after dental surgery in people who have been taking the medication. Bisphosphonates can also cause atypical fractures of long bones or chronic musculoskeletal pain.[12,17]

An emerging body of data also indicates that nitrogenous bisphosphonates—which include alendronate, ibandronate, zoledronate, and risedronate—can deplete coenzyme Q10 (CoQ10), also known as ubiquinone.[48] This is an important finding because the statin drugs used to control high levels of low-density lipoprotein (LDL) cholesterol in people who have,

or who are at risk for, cardiovascular disease also decrease the formation of CoQ10,[49] so its levels may fall dangerously low in a patient taking a statin drug along with a nitrogenous bisphosphonate. That puts the patient at risk for congestive heart failure, high blood pressure, fatigue, and other cardiovascular problems. The only way to monitor that is to measure blood levels of CoQ10, and that can be a costly test.

Strontium

Strontium is an element that belongs to the same family as calcium. This element's structure is similar to that of calcium, and the body readily takes it up and incorporates it into bone in a manner similar to that for calcium.[2] For this reason, strontium competes with calcium for intestinal absorption, so the two minerals should not be consumed at the same time. Strontium also displaces magnesium from bone, with unknown consequences.

Strontium ranelate has been the subject of extensive research as an agent for treating osteoporosis. Although strontium occurs naturally, ranelic acid is a synthetic molecule, and strontium ranelate is only available as a prescription drug in Europe, where all the studies have been conducted. A 2006 Cochrane review gave strontium ranelate silver-level evidence for increasing BMD and reducing vertebral fracture in postmenopausal osteoporosis[50]; however, this molecule's long-term safety remains controversial.[51] Furthermore, strontium ranelate hasn't been approved by the U.S. Food and Drug Administration (FDA), so this agent is not available in the United States. I am uneasy about the potential side-effects of stomach upset and serious skin rashes from strontium ranelate, and I am especially concerned about the increased risk of blood clots, myocardial infarction, seizures, and liver toxicity, which led a committee of the European Medicines Agency to recommend in January of 2014 that the agent's use for osteoporosis be suspended.[52]

There is no human research at all on strontium citrate, which is sold as a dietary supplement as an alternative to the ranelate, so it is completely unknown if this form of the mineral is safe or effective.

Raloxifene

Another pharmacologic agent for treating and preventing osteoporosis is raloxifene, which acts on estrogen receptors to produce effects that both resemble and antagonize those of estrogen.[53] Like the antineoplastic drug tamoxifen, which also acts on estrogen receptors, raloxifene is used both to treat and reduce the risk of breast cancer but has also been approved by the FDA for preventing osteoporosis in postmenopausal women.[54] In my opinion, raloxifene is generally safer than estrogen replacement for this purpose, although raloxifene still carries the risk of causing blood clots and shouldn't be used for patients with histories of strokes, deep-vein thrombosis (DVT), pulmonary embolisms, or other clot-related conditions.[55] There may be an emerging case for using raloxifene to address osteoporosis. Apart from being expensive, it doesn't seem to have a major downside, and it may become increasingly popular in view of the concerns surrounding ERT.

The Vital Role of Nutrition

As in all aspects of health, nutrition plays a vital role in preventing and countering osteoporosis. Calcium; phosphorus; magnesium; boron; vitamins A, K, D, and E; and other nutrients are needed to build and maintain bone mass.[56] Both animal and clinical studies suggest that phytoestrogens—such as the isoflavones in soy (*Glycine max*) or lignans in flax (*Linum usitatissimum*) seed meal, which bind to and activate estrogen receptors in the body—can have positive effects on bone density and strength.[57]

Because soy foods are viewed as natural products, some women consume these foods for the potential benefits of their isoflavone content. Synthetic analogues of soy isoflavones, such as ipriflavone, are also available as dietary supplements. I have no concern about suggesting tofu, tempeh, miso, or soy milk to a woman who is looking for alternatives to hormone replacement. There is some evidence that ipriflavone and the aglycone of genistein may help preserve bone in patients with osteoporosis,[58,59] but when using high doses of soy isoflavones in isolation, one is now dealing with chemical compounds that could act more like estrogens, so I would like to see more clinical studies to ensure these compounds are safe to use over the long-term.

Calcium

Calcium is present in bone as hydroxyapatite, a mineral that includes calcium phosphate and calcium hydroxide and that constitutes 70% of bone.[60] Given the high percentage of calcium in bone, it would seem logical to assume that calcium deficiency would be one of the main causes of osteoporosis, and that calcium supplements would be the single best treatment. However, the situation turns out to be much more complex than that simple paradigm suggests. It has become increasingly evident that calcium is a not a magic cure for osteoporosis and that a broad range of nutrients is needed for optimal bone health.

Even so, there is reasonably good evidence that a moderate amount of supplemental calcium (500–600 mg per day) can be an effective preventive measure against osteoporosis, especially for young women with an otherwise low calcium intake.[61,62] To be effective, calcium intake has got to begin before puberty and be part of a lifelong nutritional strategy. One can't suddenly add calcium to bones and expect to see dramatic results if calcium has been leaching out of the bones over many decades. In addition, studies show that calcium supplementation has to be combined with an exercise program in order to increase bone density.[63]

Moreover, the North American diet is often deficient in calcium. Although the recommended dietary allowance (RDA) of calcium is 1200 mg per day, most American women over age 40 consume less than half of this.[2,64] A 5-year study of 830 postmenopausal women who consumed 1200 mg of calcium carbonate per day found that they had only 66% of the risk of fracture of a control group of women not taking supplemental calcium.[65] The National Institutes of Health recommends

routine calcium supplementation of 400–800 mg per day, together with vitamin D, magnesium, silicon, vitamin K, and boron supplementation.[2]

Several published studies have suggested that calcium supplementation could increase vascular calcification and the risk for cardiovascular disease.[66,67] However, a recent, extensive review[68] conducted by a group of academic and industry experts in the fields of nutrition, cardiology, epidemiology, food science, bone health, and integrative medicine, found that the research implicating calcium in cardiovascular disease has serious methodological flaws. Led by the renowned osteoporosis expert Robert P. Heaney, MD—of the Creighton University School of Medicine, in Omaha, Nebraska—the team of experts concluded that "bias and confounding cannot be excluded as explanations for the reported associations [between calcium supplementation and cardiovascular risk]," and that there is "little evidence for plausible biological mechanisms to link calcium supplementation with adverse cardiovascular outcomes." Consequently, the authors of that review do not believe the existing data merit a change in the Institute of Medicine's recommendations for calcium supplementation for maintaining optimum bone health in people who don't obtain the recommended intakes through dietary sources.[68]

Vitamin D

To be of benefit for maintaining bone mass, calcium must be absorbed by the intestine; this is a process that requires vitamin D. The chief dietary sources of vitamin D are fortified dairy products, eggs, and fatty fish, while the body makes vitamin D through the action of sunlight. Within the body, vitamin D is transformed into 25-hydroxyvitamin D or calcidiol, primarily in the liver, and subsequently, 1,25-dihydroxyvitamin D_3 or calcitriol, primarily in the kidney.[69,70] Low blood levels of 25-hydroxyvitamin D are common among elderly persons throughout the world.[30] In the United States, vitamin D deficiency has been reported in ~ 70% of children,[71] and a similar prevalence has been reported in adults.[2]

It is difficult to obtain an adequate intake of vitamin D entirely from dietary sources. The average adult American diet provides only 150–300 international units [IU] of Vitamin D per day.[2,69] The United States Preventive Services Task Force recommended against daily supplements of < 400 IU of vitamin D and < 1000 mg of calcium for preventing fractures in postmenopausal women, although the Task Force did not reach a conclusion about a benefit of larger doses of either of these nutrients.[72]

In contrast, a task force of the Endocrine Society recommended a dietary intake of 600–800 IU per day for adults, noting that a higher intake may be optimal and suggesting that the vitamin be measured as its 25-hydroxyvitamin D metabolite in blood as a reliable initial means of detecting its deficiency.[73,74] A 2005 meta-analysis of data from multiple studies found that daily supplementation of vitamin D in the range of 700–800 IU reduced the risk of fractures and that a dose of 400 IU daily was not as effective.[75]

Like any other single nutrient, vitamin D is not a cure for osteoporosis, and an adequate daily intake of vitamin D should be viewed as a lifelong practice rather than as a quick fix. I believe that a major problem with most studies of vitamin D is that they don't use enough. An intake of 400, or perhaps even 800, units per day does not seem sufficient to affect calcium metabolism positively. This was the argument made by Michael Holick, PhD, MD, a professor of medicine, physiology and biophysics at Boston University School of Medicine, in Massachusetts, and a member of the Endocrine Society task force. Dr. Holick made a very compelling case for basing adequate dosage of vitamin D on sequential measurements of circulating blood levels of the 25-hydroxyvitamin D metabolite.

Serum levels of vitamin D change with the seasons and can decline dramatically in autumn and winter. For this reason, I typically measure 25-hydroxyvitamin D levels between seasons or up to four times per year for my patients. Believing that one can obtain adequate levels of vitamin D entirely from sunlight is a widespread mistake. I have been surprised to see how many people have low blood levels of the vitamin, even in my practice in Colorado, where there is considerable sunshine in both winter and summer and where people spend a lot of time outdoors.

In working with my own patients, I generally start vitamin D supplementation at ~ 1000–2000 IU per day and increase to 5000–8000 IU per day when necessary. Even at a typical dose of 5000 IU per day, I almost never see levels of 25-hydroxyvitamin D_3 that are above the normal range. On the rare occasion that I do see levels that border on being excessively high, I simply recommend stopping the supplement for 1 or 2 months until the levels come back into the normal range.

Vitamin K

Vitamin K is another option for preventing and treating osteoporosis. Vitamin K is essential for blood coagulation and bone metabolism. It is also vital for the body's synthesis of osteocalcin, the protein that guides crystals of hydroxyapatite into place in growing bone. A number of studies have found that deficiency of vitamin K leads to a loss of BMD and an increased risk of fracture.[2,76,77]

Dietary sources of vitamin K include prunes and green leafy vegetables, such as kale and spinach, which contain vitamin K in the form of vitamin K_1, or phytonadione. A second form of the vitamin, known as vitamin K_2, and a group of related substances, collectively known as menaquinones, are made in the bodies of humans and other mammals. Another form of the vitamin, designated MK7, is found in soy and soy products. Menatetrenone, a synthetic version of vitamin K_2, also known as MK4, has been researched extensively in Japan, where it has been shown to sustain BMD and reduce the risk of osteoporotic fractures significantly.[78] The dose of MK4 used in most of the Japanese studies was 45 mg per day. I commonly prescribe both MK4 and MK7 for my patients who have osteopenia or osteoporosis.

The optimum daily intake of vitamin K has been established as 90 µg per day for women and 120 µg per day for men.[2]

However, the Third National Health and Nutrition Examination Survey (NHANES III) found that only about half the adult population of the United States has an adequate intake of vitamin K,[2] with the remaining half subject to inadequate bone mineralization and the risk of fracture. This and similar findings have led to the supplemental use of vitamin K for addressing osteoporosis. As with other nutrients, vitamin K supplementation, by promoting osteocalcin, is intended to contribute to bone density. However, this supplementation must be done with great care in patients who are taking anticoagulant drugs, such as warfarin, because vitamin K can reverse their anticoagulant effects.

Magnesium

I find it puzzling that mainstream biomedicine often seems to overlook the essential role magnesium plays in preventing a wide range of health conditions, including osteoporosis. Magnesium is available in numerous foods, especially green leafy vegetables, whole grains, and nuts.[2,79,80] This mineral influences bone formation through effects on the concentrations of both parathyroid hormone and vitamin D, and on the function of osteoblasts and osteoclasts.[81]

The adult skeleton contains as much as 60% of the body's magnesium,[82] and population-based studies have found that intake of magnesium is positively associated with BMD in both men and women.[79,80] Yet a study of more than 4200 participants in the 1999–2000 National Health and Nutrition Examination Survey (NHANES) found magnesium deficiency in a quarter of participants who were ages 25–74, and concluded that supplementation can be an important source of magnesium.[83] Magnesium supplementation makes a lot of sense, especially as part of a comprehensive program against bone loss. I commonly advise my patients with osteopenia or osteoporosis to take ~ 300 mg of magnesium per day in the form of bisglycinate, a chelated form magnesium that is particularly well-absorbed and less likely to cause diarrhea than other forms.

Silicon

Traditional herbalists have long used the herb horsetail (*Equisetum arvense*) for enhancing bone quality, and there is at least one published study supporting its effectiveness for osteoporosis.[84] Horsetail is rich in silicon, a common element that is widely overlooked, but is nevertheless essential for the health of bone and connective tissue. Silicon is often dismissed as an inert chemical (silicon dioxide) found in quartz and sand[85] but is, in fact, present in many foods including bananas, carrots, cereals, grains, and beer.

With respect to bone strength, silicon is a constituent of prolyl hydroxylase, the enzyme that generates the collagen matrix that forms the frame on which hydroxyapatite and the other minerals in bone are deposited.[86,87] Although epidemiologic studies have reported that a daily dietary intake of > 40 mg of silicon correlates with increased BMD, the average dietary intake of silicon is only 20–30 mg per day. Daily supplementation, using 20–30 mg of silicon, has been suggested as a means of improving bone health.[2]

For dietary supplementation I advise my patients with osteopenia or osteoporosis to take silicon in the form of choline-stabilized orthosilicic acid (OSA), which is well-researched and highly bioavailable.[88] The usual dose is 5 mg twice per day, although up to 20 mg daily has been used in clinical studies. After many years of prescribing OSA, I have found it to be safe and remarkably effective, with no discernable side-effects.[89,90]

Conclusion

Osteoporosis continues to be a significant cause of morbidity and increased mortality around the world. Clearly, the answers are not all in for why osteoporosis occurs or for the optimal way to treat it. Once osteoporosis is established, mainstream medications have not been shown to prevent the occurrence of fractures fully, and are expensive and prone to causing potentially serious side-effects. Estrogen therapy can be helpful for postmenopausal women, but carries its own set of risks that may not be acceptable for some individuals. For this reason, an evidence-based integrative approach that includes regular weight-bearing exercise, a diet rich in fruits and vegetables, and appropriate supplementation with calcium, magnesium, silicon, vitamin D, and vitamin K is the most comprehensive solution to this serious public health problem. ■

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