Osteoporosis: An Overview and Treatment Options

Introduction

I have researched and written about this subject because my wife has osteoporosis. I was also encouraged to write this by Zoe's doctor, Lois Johnson, MD of Sebastopol, California. She has worked with Zoe over a number years to help treat her osteoporosis. Lois is an amazing Health Care Practitioner and I highly recommend her. As of this writing of this paper she is still taking new patients.

Our goal was to gather as much information as possible, from the available resources, to help her make an informed decision about treatment options, both alternative and traditional (orthodox).

Books have been written about osteoporosis and there is a wealth of information on the Internet. Thus, I will not attempt to repeat what is available but, for those who are interested, I will provide website links* to resources that will provide more in-depth information.

The body is a miracle! Everything is connected and nothing can be dealt with in isolation. The body continues to function, as best it can, regardless of our understanding of it. The study of the human body is also very complex so I've done my best to describe what I've learned in lay language - but some of the studies I cite are technical. In those cases I will use lay language to summarize what I believe to be the relevant information presented in the study. If necessary, you can ask your health practitioner to help you interpret it.

The information I'm providing is what we used to put together a treatment program for my wife. The program was personalized for her and is not meant to be copied by anyone reading this. It is important to understand that, when it comes to treating osteoporosis, I don't believe there is a 'one size fits all' approach.

Everyone is unique and it will be very important to first get an accurate assessment of the extent of your osteoporosis and then carefully evaluate treatment options with your health practitioner. It is my hope that the information contained herein will help you work more closely with your health practitioner in making the best treatment choices for your situation.

While I will provide an overview of osteoporosis and discuss traditional medical treatments, my primary focus here will be on the supplements and exercise programs we've researched that we feel are the most effective at not only increasing bone density but bone strength - while reducing the risk of fractures. In the *Summary* section I will tie everything together.

*(The links I provide were active when I reviewed them and wrote this osteoporosis paper. But there is no guarantee that any webpage listed here will always be accessible. Thus, I encourage you to print out any page you are interested in to make certain that you will always have access to the information on that page. You can open a link by putting your cursor over the link, pressing the CTRL button and left clicking it. If a link won't open when you use Ctrl/Left-Click you can copy the link and paste it into the address bar of your Internet Browser.)

Osteoporosis

Osteoporosis is defined as a condition that causes a loss of bone density and bone strength due to a loss of calcium (Ca) (and other bone minerals), bone protein, and bone collagen matrix. As

bone loss progresses it can severely weaken bones structurally and increase the risk of bone fracture. It can also increase the risk of actually dying from those fractures.

Fractures related to osteoporosis are more commonly seen in the spine, hip, rib, and wrist. The main reason these areas are at a greater risk of fracturing is that they are predominately made up of the less dense trabecular bone - which I will discuss in more detail later.

As bone loss increases it literally leaves more 'holes' in the bone where the material making up the bone used to be (mainly calcium, but also of collagen - the matrix that the minerals are deposited on). These holes, or spaces, that are left are then filled with fatty substances or more bone marrow, neither of which provides density or strength to the bone.

Osteoporosis can occur in women and men. But those at the highest risk are women who are post-menopausal; white and Asian - and those who are thin and small boned.

There is also a recognized condition known as osteopenia. I define this as pre-osteoporosis and it is like an early warning system that should definitely motivate you to do something before it gets worse. Not everyone with osteopenia will end up with osteoporosis but everyone with osteoporosis also went through the osteopenia phase. In this situation, an ounce of prevention is truly worth a pound of cure!

Here is a link to a website that provides a very good overview of osteoporosis. http://medical-dictionary.thefreedictionary.com/osteoporosis

Osteoporosis is More Commonly Found in Women

1. 68 percent of the 44 million people in the USA who are at risk for osteoporosis are women.
2. One out of 2 women will suffer from an osteoporosis related fracture in their lifetime. versus 1 out of 4 men.
3. 75% of all hip osteoporosis occurs in women.

There are several reasons why osteoporosis is more common in women.

1. Women generally have less bone density to begin with than men.
2. Women lose bone mass more quickly than men.*
3. A dramatic drop in estrogen production, which takes place with menopause or when ovaries are removed, will accelerate bone loss. (I discuss the role of estrogen in osteoporosis later in the article under the section *Contributors to Osteoporosis*.)

More information about the relationship of gender to osteoporosis can be found at http://www.everydayhealth.com/osteoporosis/osteoporosis-and-gender.aspx.

*(It is known that the majority of women aren't as physically active (in regard to weight bearing exercise or weight bearing physical work) as men and have less muscle mass. It is also well known that weight bearing exercise, and physical weight bearing work, can slow or prevent a loss in bone density. Thus, women who are less active physically, in regard to weight bearing exercise or work related weight bearing, could be at a greater risk of developing osteoporosis. This alone could be a significant contributing factor as to why more women develop it than men.)

Bone 101

Before I get into the specifics about the many factors that contribute to osteoporosis - and the treatment protocol my wife is following - I felt it important to learn bone basics. This is because it is *bone* that we are talking about and without a basic understanding of it you will not be able to fully understand osteoporosis - its cause or its treatment.

There are many websites that deal with bone and its formation. The best one I've found that provides a very good and easy to understand overview of bone is: http://depts.washington.edu/bonebio/ASBMRed/structure.html. I encourage anyone who wants to learn more about bone to read it. I will summarize some of the key aspects of the article that I feel are important to consider.

Function of Bone

Bone has many functions. Primarily it is the body's framework and it is what organs and muscles attach to via ligaments and tendons. Bone is also in constant flux and, even in normal healthy conditions, it is continually being broken down and built up.

The primary reason for this is that the bone is the body's warehouse for storing calcium and phosphorus. In fact, bone holds 99% of all the calcium (Ca) found in the body. It also stores about 85% of all phosphorus (P). Calcium is not only necessary for optimal bone health, it is critical for keeping the body's blood calcium levels within the normal range, and other important functions.

Over time, a calcium deficiency can contribute to symptoms other than osteoporosis; such as memory loss, numbness in the hands and face, and muscle spasms. *If the rest of the body isn't getting enough calcium from the diet, or assimilating enough of what it ingests, it will take what it needs from bone to keep blood levels normal.* This is important to understand and will be discussed in more detail later.

Composition of Bone

Bone is comprised of inorganic hydroxyapatite, primarily calcium and phosphorus, and organic collagen - a very strong and elastic protein that is also a major component of tendons, ligaments and skin. As bone develops, the collagen matrix is formed first and then it becomes calcified as the minerals Ca and P attach to specific sites on the matrix. Collagen makes up to 20% of total bone mass but the amount will vary in the different types of bone.

Bone is also very vascular, containing an abundant supply of blood vessels. If you thought that bone was a solid mass of calcium and phosphorus, you'd be wrong. Bone is denser than any other body tissue but, as mentioned, there are holes/spaces found throughout all bone. These holes contain blood vessels, fats and vital bone marrow - both red and yellow.

Types of Bone

There are two main types of bone:

Trabecular Bone (also known as spongy or cancellous bone). This type of bone is what is found underneath (or within) the much denser, harder, outer, cortical bone. It is less dense, softer, and consists of more collagen matrix than cortical bone. The 'holes' (spaces) within the trabecular matrix contain some fat but mostly bone marrow. Both trabecular bone and cortical bone are extraordinarily rich in blood vessels.

Cortical Bone: This is the outer portion of bone. It is much denser, with less collagen and a higher proportion of minerals, and makes up to 80% of the skeleton's total bone mass. The cortical bone has to be denser because it is where the ligaments and tendons attach to and where greater stress is placed on the bone. You can see this on x-rays where the denser bone shows up whiter than less dense bone, such as the hip or vertebrae. (The reason it shows up whiter on x-rays is that the denser the bone the less the x-rays can penetrate it and expose the film. X-rays can better penetrate the softer trabecular bone, making it appear more grayish.)

In a sense, the denser cortical bone is the protector of the inner trabecular bone. But it is the trabecular bone that gives the bone its elasticity, or flexibility (or strength). While the roles they play are different, both types are essential to optimal bone health.

Cells that Make Bone, Break Down Bone, & Stimulate Bone Growth

Osteoblasts

These bone cells, derived from red bone marrow, are the cells that build/manufacture bone. Technically they don't make bone itself but produce a protein (osteocalcin) that will attach to the existing bone matrix. Osteoblasts also control how the bone will be mineralized. Simplistically, they make and position the protein that forms the matrix that the calcium and phosphate ions attach to. The result is new bone.

But if the osteoblasts aren't stimulated to form osteocalcin, new bone growth will be decreased or stopped. As you will see, while sufficient amounts of calcium (Ca) and Phosphorous (P) are absolutely necessary, vitamin D3, plus a variant of Vitamin K (K2), and other factors are also essential to the bone growing process. Osteocalcin can also inhibit osteoclasts - the cells that break down bone.

Osteoclasts

Simply put, osteoclasts dissolve, or breakdown bone. These cells are ever present but are usually dormant until stimulated by various hormones or chemicals. The primary hormone that the body produces that activates and controls osteoclast production is the parathyroid hormone. When calcium levels in the blood fall below the normal range, parathyroid hormone is released. Once enough calcium has been released from the bone to return blood calcium levels to normal the osteoclasts will cease dissolving bone. But if the lost bone isn't then replaced, a net loss of total bone will occur.

Osteocytes

Osteocytes are also found in bone and serve a very important function. The role they play is to stimulate new bone production when there is increased physical/mechanical stress - or a bone fracture. Thus, one obvious role of osteocytes is to stimulate osteoblasts to make new bone when there is a bone fracture. But what is even more important to those dealing with osteoporosis is the role osteocytes play in weight bearing exercises designed to strengthen bone. This too will be taken up in more detail later.

Bone Marrow

There are two types of bone marrow, yellow and red. They both are found in abundance in trabecular bone - but also in cortical bone. The red marrow produces red blood cells (which are necessary to transport oxygen in the blood to every cell in the body). The yellow marrow produces white blood cells (or leukocytes) that help fight infection. Blood platelets (thrombocytes), essential for blood clotting to be effective, are also produced in bone marrow. (I

did not find a direct relationship between bone marrow and osteoporosis except that as more trabecular bone is lost, more marrow is produced to fill the 'spaces' left by the bone.)

Risk Factors and Contributors to Osteoporosis

My research did not lead me to believe that there is one specific cause of osteoporosis. What I did find is that there are so many risk factors/variables involved, that no one factor can be shown to be the specific cause - and none can be excluded as contributors.

This means that **all** of the contributing factors listed below must be looked at and considered when diagnosing osteoporosis and designing the best treatment options. The following are what are believed to be the main contributing factors. Keep in mind that some may be bigger contributors than others. (The list of risk factors below is not in any order and should not be taken to indicate that one is more significant than another.)

Age

Not every older person (over 50) is diagnosed with osteoporosis. Of course there will be bone loss due to age related biological reasons, but age alone is not the accepted cause of osteoporosis. If that was the only cause then everyone past the age of say 60 would be diagnosed with osteoporosis.

But age cannot be excluded as a contributing cause of osteoporosis. We know that the 'average' person loses around 10% of his/her muscle mass every decade (http://www.weightwatchers.com/util/art/index_art.aspx?tabnum=1&art_id=45071). Plus, most people do less weight bearing exercise and less physical weight bearing work as they age - particularly women.

Although I haven't found a study that deals with this, it is my opinion that women - who have not been active from a weight bearing perspective throughout their lives - would be at greater risk of suffering from osteoporosis - and at an earlier age - than those who were more active. All other factors being equal.

I recommend that if you haven't been, or are not now, physically active in regard to all forms of weight bearing exercise, that you get tested for osteoporosis at an earlier age than is normally recommended.

Hormones

Parathyroid Hormone

As was briefly mentioned, when the blood calcium levels fall below the normal range - parathyroid hormone is released by the parathyroid glands. When this hormone is released it will increase blood calcium levels by activating bone osteoclasts to dissolve bone and release the stored calcium into the blood. Thus, any abnormal condition of the parathyroid glands that causes excessive release of parathyroid hormone could be a significant contributor to osteoporosis.

(Under certain conditions the parathyroid hormone can actually stimulate bone formation. This fact is the basis for one of the more effective traditional treatments for osteoporosis and will be discussed in that section.)

On the other side of the coin, too much calcium in the blood will stimulate the production of Calcitonin, a hormone secreted from the thyroid gland. Its purpose is to remove excess calcium from the blood. As part of that process it will:

- inhibit osteoclast reabsorption (preventing bone breakdown)
- delay calcium absorption from the intestine
- increase calcium urinary excretion

In other words, too much blood calcium can also be a problem and so the body has a number of mechanisms in place and will do what is necessary to get rid of the excess calcium found in the blood.

Again, this is an example of the miracle of the body. It responds to too little calcium and to too much calcium. This website has some good basic information about the parathyroid glands, http://en.wikipedia.org/wiki/Parathyroid_gland

Genetics
A genetic predisposition for osteoporosis will play a role for some individuals. Genetics as a contributor, or cause, of osteoporosis may not be that common but studies show that it exists. You can learn more about it at http://www.csa.com/discoveryguides/archives/osteo.php

From what I've learned, if you have a genetic predisposition for osteoporosis it would show up very early and wouldn't first appear in later years. If you feel you may be genetically predisposed for osteoporosis then I believe that you would benefit even more if you tested early for it and consider all forms of treatment, both alternative and traditional. An accurate health history would be very useful to your health practitioner if you believed you had a genetic issue - particularly a family history of osteoporosis at an early age.

Medications/Pharmaceutical Drugs
A very good explanation of the medications that can contribute to osteoporosis can be found at http://www.osteoporosis-vitamins.com/medications-that-cause-osteoporosis.html. I have not researched all of them in detail because my wife only takes one that is listed, thyroid medication. Thus, it will be up to each individual to evaluate if any of them are relevant. There is usually a very good reason why all of these medicines are prescribed and why they shouldn't be discontinued. So this becomes a delicate balance and in need of a full evaluation and discussion between you and your health practitioner.

My suggestion is that if you are taking any of the medications listed below I encourage you to speak with your health practitioner about them - particularly in relationship to your osteoporosis treatment.

- Steroids or Corticosteroids
- Thyroid Medication
- Antacids with Aluminum
- Proton Pump Inhibitors (PPIs)
- Antibiotics
- Anticonvulsants
- Diuretics
- Heparin and Coumadin (Warfarin)
- Lithium

- Methotrexate
- Gondadotropin

Too Little Calcium Intake
Calcium is an element (Ca) and the body cannot make it. This means it has to get calcium from the diet, supplements, or both. Diets vary and many people aren't taking supplements that contain enough calcium, or enough of it in the bioavailable form. Thus, those who may need calcium the most may not be getting enough of it from either of these sources.

This is an important consideration - because if enough calcium isn't taken in and assimilated from the intestine into your body - it won't matter if you had any of the other risk factors. Simply, if everything else is equal but you aren't ingesting and absorbing enough calcium it could be a major contributor to osteoporosis.

This is one of the better website pages that show foods that are highest in calcium http://nof.org/articles/886. You can also use supplements to add calcium to your diet. I will discuss the ones we selected later but I encourage you to speak to your health practitioner about them. In its elemental form, all calcium is the same. But there are many different formulas for calcium supplements and some are more readily assimilated (bioavailable) by the body than others.

What must also be understood is that even if your diet is high in calcium, or you are taking adequate amounts of calcium supplements, it doesn't guarantee that the calcium you ingest/swallow will actually be absorbed from the intestine into the body.

Inadequate Absorption of Calcium from the Intestine
In regard to absorption, no matter how much calcium you ingest/swallow from your diet, or get from the supplements you take, if it isn't absorbed from the intestine, the body (blood, cells and bone) will not have access to it. This can lead to a false sense of security. For example, you know you are eating foods high in calcium and also taking Ca supplements. Therefore, everything should be OK - and from the perspective of swallowing/ingesting Ca - it is.

But if the calcium ingested isn't being absorbed from the intestine into the body the only other place the body can get the calcium the blood and other cells need is - **from the bones!** Obviously this situation in itself could well be a major cause/contributor to osteoporosis.

So both taking in enough calcium and assimilating enough calcium must be evaluated. One major factor that dramatically affects this is the adequate intake of vitamin D3.

Insufficient Vitamin D3 (Cholecalciferol)
This takes us to the importance and need for vitamin D3. What is commonly referred to as Vitamin D3 isn't really a vitamin. It is a hormone produced in the kidney with help from a dietary vitamin precursor (vitamin D) and ultraviolet (UV) light (sunlight). A deficiency of Vitamin D3 will:

- block the absorption of calcium and phosphorus from the intestine.
- prevent bone mineralization
- increase calcium urinary excretion

Vitamin D3 is discussed in more detail in the section on *Treatment of Osteoporosis.* (Of note is that studies have shown that a UV tanning lamp, that emits UV light, will provide enough UV

rays to produce D3. This is good news for those who live in areas with less sunlight or aren't able to get outdoors.)

Lack of Vitamin K2 (both the MK-4 and MK-7 forms)
These will also be discussed in detail in a later section

Excessive Thyroid Hormone (Hyperthyroidism)
A very good website that deals with the relationship of hyperthyroidism and osteoporosis is http://www.nos.org.uk/NetCommunity/Document.doc?id=1368 I felt this website did a great job of explaining this condition so I will quote it directly. "Bone is continuously being broken down and replaced by cells known as osteoclasts and osteoblasts.

Each cycle of bone 'turnover' takes about 200 days and excess thyroid hormone will hasten this rate of bone turnover. If this process is happening too rapidly the bone building cells (osteoblasts) are not able to replace your bone fast enough, thus the overall rate of bone loss is increased. If your thyroid hormone levels stay too high for too long, there is an increased risk of developing low bone density and osteoporosis, particularly if you are a post-menopausal woman and research has shown a potential increased risk of fracturing your hip.

Hyperthyroidism can also be associated with muscle weakness and loss of lean body (muscle) mass, which can be quite severe in some cases. This can then lead to an increased risk of falling and subsequent broken bones."

My interpretation of the research showed that hyperthyroidism is increasing in the United States and many people haven't been properly diagnosed. Hyperthyroidism also affects more women than men and I believe it should be taken into consideration when assessing the potential risk factors for osteoporosis.

What should also be considered here is the effect of hyperthyroidism on muscle weakness. Weak muscles and poor balance can cause falls, **which in turn can cause fractures.** Because of this I will discuss the importance of including exercises to help with balance as a supportive treatment of osteoporosis. Of course compression fractures of the spine can still occur without a fall.

Glucocorticoids (Cortisol)
Gluocorticoids are a type of steroid hormone that is produced by the adrenal glands and necessary for many important functions, including the metabolism of glucose to create energy. They are also secreted in response to inflammation. But if too much Cortisol is secreted it can:

- decrease calcium absorption from the intestines
- inhibit bone formation
- increase bone breakdown
- increase renal calcium excretion

(You can find more information about the role glucocorticoids play in osteoporosis at http://en.wikipedia.org/wiki/Glucocorticoid.) I believe that in many instances inflammation is relatively short term. You have a cut, it gets infected, you treat it, and it heals. But there is one much more serious form of chronic inflammation that is not short-term, but chronic in the sense that it exists 24/7 - until effectively treated and eliminated.

The chronic inflammation I am speaking of is gum disease. In relationship to cortisol release it most certainly can play a role in osteoporosis, even early osteoporosis. Here is a link to a study that proves this relationship, http://www.dentalwellness4u.com/dentaldisease/osteoporosis.html

If you have gum disease, or aren't sure, you should let your health practitioner know and get examined by a qualified dentist. Gum disease can also contribute to other, even more serious, health problems - including heart disease.

You can learn more about how gum disease contributes to many other health issues, and what you can do about it at http://dentalwellness4u.com/dentaldisease/intro.html.

Role of Estrogen

The role estrogen plays, in both women and men, is very complex and for this article there is no need to detail its full function in relationship to overall health. But in regard to osteoporosis a lack of estrogen production will have a dramatic affect on the breakdown of bone and a loss of bone mass density. (There are three primary forms of estrogen produced in women, estrone (E1), estradiol (E2), and estriol (E3). But for the purpose of this article I will use the term estrogen.)

The relationship between a decrease in estrogen production and bone loss is a direct one. Simply put, as the levels of estrogen decrease the amount of bone loss increases. A lot of research has been done in this area so I will just do an overview here and include links to relevant websites.

One new study, found at http://www.sciencedaily.com/releases/2007/03/070323171448.htm suggests that the mechanism by which estrogen protects bone is by blocking an enzyme that is involved in killing bone building osteoblasts. If there isn't enough estrogen to block this enzyme it will cause a decrease in osteoblasts - and an increase in bone breakdown.

Another way that estrogen protects against bone loss is by regulating osteoclasts (the bone cells that breakdown bone). Without adequate estrogen, osteoclasts will live longer, giving them the ability to destroy more bone. More information about this role of estrogen can be found at http://courses.washington.edu/bonephys/esteffects.html

As you can see, the role estrogen plays is two-fold. It protects osteoblasts so they can continue to grow bone. And it depresses osteoclast production, limiting the amount of bone breakdown.

There is no doubt that the loss of estrogen plays an important role in osteoporosis. I believe this is one of the main factors that contributes to an increased risk of osteoporosis, and resulting fractures, in menopausal women.

It doesn't matter if estrogen was lost because of menopause, surgical removal of the ovaries, low estrogen production, or by the natural aging process. But as you've read, estrogen depletion isn't the only factor.

In fact, estrogen replacement therapy is one of the traditional treatments options for osteoporosis and studies have shown that it protects bone mass and helps protect against the risk of osteoporotic fractures. (It should also be noted that Hormone Replacement Therapy (HRT) is known to increase the risk of breast cancer, especially if there is a family history of it.)

Removal of Ovaries Before Menopause
Among other things, the ovaries produce estrogen and when they are removed the estrogen they produce and release is no longer available. If they are removed before menopause the risk of osteoporosis increases.

I will include excerpts from a recent study done at the University of Southern California's Keck School of Medicine and taken from WebMD. I encourage you to read it. http://www.webmd.com/osteoporosis/news/20140214/ovary-removal-might-raise-odds-for-bone-loss-heart-disease

Women who had their ovaries removed before menopause are at increased risk for bone loss and cardiovascular disease, according to a new study. Among women who were more than 10 years past menopause, the rate of bone mineral density loss was twice as high in those who'd had their ovaries removed before menopause than in those who still had their ovaries.

Decreasing levels of estrogen hormones affect the severity of both health issues. While hormone levels gradually fall through menopause, they can decline suddenly when the ovaries are removed. [I consider this last sentence to be very significant because a dramatic and sudden loss of estrogen can have a far greater, and immediate (acute) impact on bone loss, than the gradual loss of it over time (chronic).]

Vegetarians Who Don't Supplement with Vitamin K2 (MK-4)
These comments here are mine and I have not seen a specific study on this to support them. But I do feel they warrant consideration when assessing risk factors for osteoporosis and are worthy of discussion with your health practitioner. My opinion is based on the importance of adequate MK-4 (which I go into in detail later in the article) necessary to prevent bone loss.

The primary source of MK-4 is animal products. Obviously vegetarians/vegans do not consume animal products and thus would likely be deficient in MK-4. As you will read later, MK-7 is also important in bone health and its primary source is not from animal products. But the fact that MK-7 is found in fermented soy beans and other fermented vegetables, like sauerkraut, would also limit the amount of MK-7 taken in - even by vegetarians.

Based on the information I found, and my interpretation of it, I would consider long-term vegetarian/vegan women to be at a greater risk of osteoporosis.

Excessive Intake of Vitamin A
Some studies have shown that excessive daily intake of vitamin A (as retinol, retinyl palmitate, or, retinyl acetate) were associated with osteoporosis and an increase risk of fracture. One study showed that women taking more than 6,660 IU daily of vitamin A were found to have twice the hip fracture risk compared with those taking less than 1,700 IU. Another study showed that men with the highest levels of retinol are 7 times more likely to fracture a hip than men with lower levels. http://www.ncbi.nlm.nih.gov/pubmed/12540641?dopt=Abstract) (It should be noted that beta carotene form of vitamin A, which most people take, is not associated with osteoporosis or fractures.)

More information can be found at http://www.webmd.com/osteoporosis/news/20030122/vitamin-bone-poison

Smoking and Osteoporosis

There are many reasons why smoking is bad for your health. Now another reason for not smoking has been added to the list. There is now evidence that smoking is a risk factor for osteoporosis. The following was excerpted from an article in the National Institute of Health (NIH) Osteoporosis and Related Bone Diseases ~ National Resource Center website titled *Smoking and Bone Health*.
http://www.niams.nih.gov/Health_Info/Bone/Osteoporosis/Conditions_Behaviors/bone_smoking.asp

In addition, most studies on the effects of smoking suggest that smoking increases the risk of having a fracture. Not all studies support these findings, but the evidence is mounting. For example:

- The longer you smoke and the more cigarettes you consume, the greater your risk of fracture in old age.
- Smokers who fracture may take longer to heal than nonsmokers and may experience more complications during the healing process.
- Significant bone loss has been found in older women and men who smoke.
- At least one study suggests that exposure to *secondhand smoke* during youth and early adulthood may increase the risk of developing low bone mass.
- Compared with nonsmokers, women who smoke often produce less estrogen (a sex hormone) and tend to experience menopause earlier, which may lead to increased bone loss.
- Quitting smoking appears to reduce the risk of low bone mass and fractures. However, it may take several years to lower a former smoker's risk.

More information about the relationship of smoking to bone health can be found at
http://www.webmd.com/osteoporosis/living-with-osteoporosis-7/smoking-cigarettes

Excessive Fluoride Intake
Excessive fluoride intake can increase bone mass density but will also increase the risk of fractures. It will be explained in more detail later.

Chronic Mercury Poisoning
I include this here because of the devastating effect that chronic mercury poisoning has on the body. It not only damages the immune system but has a detrimental effect on enzymes, and enzymes play an essential role in bone health. Mercury is a heavy metal, as is lead, and both mercury and lead are deposited in bone. These heavy metals not only interfere with all cellular function, but will also deplete calcium by taking the place of calcium in the bone matrix.

You may not think you have been exposed to mercury but everyone with amalgam/silver dental fillings is being exposed to excessive and harmful levels of mercury from these fillings 24/7.

Although more study in this area is needed it is my opinion, based on my extensive research into chronic mercury poisoning, that the chronic absorption of mercury and other heavy metals, could not only contribute to osteoporosis but also result in a false bone mass density (BMD) reading.

Given the known effects of mercury on the body I would consider it to be at least an indirect contributor to osteoporosis. You can learn more about the harmful effects of mercury by linking to http://www.mercurysafedentists.com/mercurydetox/poison.html

Of interest is a study that showed that vitamin K2 protects neural cells against mercury poisoning. This is important because mercury is classified as a neurotoxin. Thus, vitamin K2 is not only an important part of any treatment for osteoporosis but helps protect against mercury toxicity. http://www.ncbi.nlm.nih.gov/pubmed/21488088

Who Should be Tested for Osteoporosis - and When*

I've excerpted information from a page on the National Osteoporosis Foundation (NOF) website. NOF has a great deal of very good information on testing and other aspects of osteoporosis, http://nof.org/articles/743

NOF recommends that you should be assessed for osteoporosis and have a bone density test if you are a:

- man, or postmenopausal woman, age 50 and older who has recently broken a bone.
- woman age 65 or older
- woman of menopausal age with risk factors
- postmenopausal women under age 65 with risk factors
- man, age 50-69 with risk factors

In addition the NOF says a bone density test may also be necessary if you have any of the following:

- an X-ray of your spine showing a break or bone loss in your spine
- back pain with a possible break in your spine
- height loss of ½ inch or more within one year
- total height loss of 1½ inches from your original height

*I purposely placed this section behind the *Risk Factors for Osteoporosis* section so you can see the relationship between them and who should be tested and when. But as you've seen, there are other risk factors apart from the more traditional ones to take into consideration. These include:

- loss of ovaries before menopause
- insufficient dietary intake of calcium
- insufficient D3
- Insufficient K2
- medications that contribute to osteoporosis
- thyroid or parathyroid disease
- genetics/family history
- excessive cortisol secretion related to inflammation
- chronic mercury and lead poisoning

Thus, it is obvious that assessing risk factors for osteoporosis should not be limited just to the more traditional factors such as age, menopause, fractures, and loss of height. The bottom line is that a complete health evaluation, including all possible risk factors, should be included in any assessment. I've not seen any statistics on this, but in my opinion a person can have multiple risk factors present, or a few. But what this really means is, no matter how many risk factors you have, it is far better to test for osteoporosis sooner than later.

Testing for and Diagnosing Osteoporosis

There are a number of ways to test for and diagnose osteoporosis and the risk of bone fracture. It is important to note that osteoporosis isn't a condition that you either have or don't. There are degrees, or stages. For example, the early stage of osteoporosis is called osteopenia.

The point here is that if you are diagnosed as having osteopenia and don't find the cause(s) and don't initiate treatment for it - it will progress over time to the more serious form. Remember, there really aren't any overt **early** signs, or symptoms, of osteopenia - or even early osteoporosis. This makes it even more imperative to start periodic screening/testing for the condition early. Treating osteoporosis is much more effective the earlier it is discovered.

DEXA Test

The most commonly used test for bone density is the DEXA Test (dual-energy x-ray absorptiometry) that evaluates bone mass density (BMD). What I feel is important to understand, and remember, about the DEXA scan/test is that it only measures the amount of calcium and other bone minerals that are present in the area being tested. It does not measure bone strength or flexibility.

Here is a link to a website that I feel gives a very good overview of the DEXA scan: http://www.womensguide.org/osteoporosis/diagnosis.html

This page also explains the T-Score that is used to assess the level/degree of bone loss. This website also lists additional tests available that can help your health practitioner identify other factors that could be contributing to bone loss. The most common blood tests evaluate:

- blood calcium levels
- blood vitamin D levels
- thyroid function
- parathyroid hormone levels
- estradiol levels to measure estrogen (in women)
- follicle stimulating hormone (FSH) test to establish menopause status
- testosterone levels (in men)
- osteocalcin levels to measure bone formation.

The most common urine tests are:

- 24-hour urine collection to measure calcium metabolism
- tests to measure the rate at which a person is breaking down or resorbing bone. One of these is the NTX Urine test.

Of course there are many more factors that go into making an accurate diagnosis than just a bone scan and all of them should be considered. The best website I found 'Making a Diagnosis' is the National Osteoporosis Foundation Website, http://nof.org/articles/8#bonedensitytest I encourage you to read what they have to say and I recommend that you print it out and take it with you when you talk to your health practitioner about testing for osteoporosis.

Other Tests

Osteocalcin as an Indicator for Bone Growth

As mentioned, osteocalcin is produced by osteoblasts and is often used as a marker for bone formation activity. It has been observed that higher serum-osteocalcin levels are relatively well

correlated with increases in bone mineral density (BMD) during treatment with anabolic bone formation pharmaceutical drugs for osteoporosis, such as Teriparatide (Forteo).

In many studies, osteocalcin is used as a preliminary biomarker on the effectiveness of a given drug on bone formation. For instance, one study which aimed to show the effectiveness of a glycoprotein called lactoferrin on bone formation used osteocalcin as a measure of osteoblast activity. http://en.wikipedia.org/wiki/Osteocalcin

Micro-MRI
I also found information about another test that can actually show more detail than the DEXA scan. It is called a micro-MRI

This emerging MRI technology shows far more detail than a DEXA scan and is said to be the best at assessing bone microstructure and better at predicting the risk of fractures. The link I'm providing is to a very detailed and scientific evaluation of the MRI used for this purpose, along with other tests. You may want to pass it along to your health practitioner.
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2901255

While this technology is promising and offers a much better way to evaluate total bone structure, it is still technically difficult to do and, as of the writing of this article, it is not widely available. This means it is not yet likely to be used in most clinical practices. I would guess that medical schools would be most likely to do this test. But I also suggest you ask your health practitioner about it.

Interpreting Blood Calcium Levels
This is an important, but I feel less understood, way of evaluating a contributing cause of osteoporosis. As was mentioned previously, testing blood calcium levels can be valuable but must be looked at in regard to the big picture.

For example, if blood calcium levels are in the normal range, and your health practitioner only used that determination to evaluate the extent of osteoporosis, it could be very misleading.

This is because if blood calcium was in the normal range but that person was diagnosed by a DEXA scan with osteopenia or osteoporosis, one could assume they were absorbing enough calcium from the diet and or, supplements. Yet that person could be deficient in vitamin D3, which will prevent the absorption of calcium from the intestine. In this scenario, the body would then take the calcium needed by the blood from the bones.

Also if the a person wasn't exposed to adequate sunlight, the contributing factor could be a lack of D3 and would have to be dealt with accordingly.

Thus, a number of factors regarding calcium have to be taken into consideration.

- Are you ingesting enough calcium from your diet and, or supplements?
- Is enough calcium being absorbed from your intestine into your body to provide the calcium needed by the blood, cells, and bones?
- Is calcium absorption being limited by insufficient vitamin D3 - along with insufficient sunlight?
- Is the body getting enough vitamin K2 (as MK-4 & MK-7) so sufficient osteocalcin can be produced by osteoblasts?

- Are the parathyroid glands producing too many hormones, increasing the breakdown of bone?
- Is the thyroid functioning properly?
- Are you taking any medications that could cause an increase in osteoclast activity?
- Is your estrogen production low, or non-existent? This includes menopause and the removal of the ovaries.

Bone Mass Density versus Bone Strength (Elasticity)

Traditionally bone mass density testing (DEXA) has been the standard for determining the amount of bone loss and the degree of osteoporosis. However, new research has shown that the health of bone is more than just about bone density. It is also related to bone strength/ elasticity - or in lay terms - the ability of the bone to bend, but not break (given the same amount of force).

For example, if a person has been exposed to high levels of fluoride (Fl) over time, the fluoride will replace the normal hydroxyl/OH portion of the bone mineral complex - called hydroxyapatite. If enough fluoride is added to the existing minerals, it will make bone significantly denser - but will also make it much more brittle - actually increasing the risk of fracturing.

On an x-ray the bone will show as being extraordinarily dense. It would also result in a DEXA score that suggest that the bone mass density wasn't indicative of osteoporosis. Thus, in this scenario, if bone mass density were the only consideration, it wouldn't indicate that the risk of fracture had actually increased.

Denser bone does not necessarily mean the bone is more flexible, or at a lesser risk of fracturing - and that is the key to everything. For example, think of a piece of chalk and a fresh willow branch. Which will break more easily given the same amount of pressure; tensile, compression, bending, or twisting, that is being exerted? The chalk of course as it isn't flexible.

The component of bone that makes it flexible is collagen, a strong and yet flexible protein that provides the matrix for the minerals (primarily calcium (Ca) and phosphorous (P) to attach to it. Collagen comprises from 10% to 20% of total bone mass and is important for both bone density and bone strength/elasticity/flexibility. Without an adequate matrix it wouldn't matter how much calcium and phosphorous your body took in, because it would not have any place to attach to. You can't nail anything to a wall that isn't there - no matter how many nails you have.

It is the unique combination of collagen and minerals that makes bone both strong (high tensile/flexibility strength) and dense (high compression strength). These characteristics also account for the types of fractures that occur with osteoporosis. For example, compression fractures of the spine would be more likely to be related to a loss in bone density - the less dense, trabecular bone can't withstand the compression it is constantly under. In general, when it comes to bone loss the type of bone that is most likely to fracture is the trabecular bone.

This should emphasize the importance of being concerned about both bone density and bone strength/elasticity. As you will learn, there is evidence that a person can show a lack of bone density but still have acceptable bone elasticity. Of course there are those who have a lack of both bone strength and bone density.

What I found from my research was that given the unavailability of the micro-MRI scan for bone strength, there is no universally acknowledged way of determining the strength/flexibility of

bone. But I also learned that if the bone cannot make an adequate amount of the collagen that forms the matrix of bone, the bone will not only be less dense, but also less elastic.

There is growing evidence to suggest that variations in trabecular structure are important in determining bone strength, independent of bone mineral density (BMD). The following is very scientific and was taken from the Discussion section. http://cds.ismrm.org/ismrm-2003/0877.pdf I believe your health practitioner would be interested in this article.

Another Perspective on Bone Strength, Bone Resiliency, and Flexibility

Even though the following article is lengthy and scientific, I'm including excerpts from it here for two important reasons.

- It deals with a form of osteonecrosis of the jawbone (ONJ) that is caused by bishosphonates (which includes Fosamax). In this case the condition is termed bishosphonate-related osteonecrosis of the jaw (BRONJ). The reason this is important here is that Fosamax is still recommended by some practitioners as a treatment for osteoporosis.
- The second reason is because it establishes the critical role that MK-4* and collagen play in bone strength/elasticity.

I'm also expanding on it because my wife took Fosamax for a number of years and while it did improve her DEXA bone density score we discovered it could also lead to an increased risk of fractures of the jaw. Of course not everyone taking bisphosphonates will suffer from jaw fractures but the risk is there and that means it should be taken into consideration and makes the decision an individual one.

The title of the article is **Bridging the Gap Between Osteoporosis and Osteonecrosis of the Jaw: A Rationale for an Approach to Preventing and Treating BRONJ with MK4***
http://www.dentalaegis.com/cced/2011/10/bridging-the-gap-between-osteoporosis-and-osteonecrosis-of-the-jaw-preventing-and-treating-bronj-with-mk4

(I realize this article is very technical but I'm including it because I feel this information is very significant in relationship to this particular traditional treatment of osteoporosis. I will highlight what I consider to be the significant parts of the article. I encourage you to read but if it is too scientific for you, I highly recommend that you provide your health practitioner with a link to it.)

"The role of collagen as postulated in this article cannot be ignored in the pathophysiology and potential prevention and treatment of osteoporosis and BRONJ. Studies from the medical literature support the safety and efficacy of MK4 as a potential therapeutic agent in preventing and treating osteoporosis and BRONJ.

.....but has been well described in the general medical literature on osteoporosis and bone histology, is the preeminent role collagen plays in bone health, fracture healing, and fracture prevention. Bone matrix is a two-phase system in which the mineral phase provides the stiffness and the collagen fibers provide the ductility and ability to absorb energy (ie, the toughness). Alterations of collagen properties can therefore affect the mechanical properties of bone and increase fracture susceptibility.

Decreased bone collagen production as indicated by bone resorption markers leads to increased susceptibility to fractures and osteoporosis. Markers of bone turnover, particularly markers of bone resorption, have been shown in prospective epidemiologic studies to be

associated with fracture risk and this association appears to be independent of bone mineral density (BMD).

Since collagen is not detected by a DEXA scan it is not part of a bone density report. Thus, in only reporting the density of bones the scans are evaluating bone quantity and not bone quality. Any discussion of bone quality would be incomplete without considering the pivotal role of bone collagen.

The family of K vitamins, including phylloquinone, MK4 and MK7, are fat-soluble vitamins that act as coenzymes for a vitamin K-dependent carboxylase enzyme that catalyzes carboxylation of the amino acid glutamic acid, resulting in its conversion to gamma-carboxyglutamic acid (Gla). This carboxylation reaction is essential for formation of bone collagen, which allows bone to deform upon impact, for example, during mastication or a fall, without fracturing. Although vitamin K-dependent gamma-carboxylation occurs only on specific glutamic acid residues in a small number of proteins, it is critical to the calcium-binding function of those proteins.

Since the fundamental premise of the Neustadt-Pieczenik Collagen Deficit and Restoration hypothesis is that preventing and treating osteoporosis and BRONJ may be successfully done by stimulating bone collage production, all three forms (phylloquinone {KI}, MK4, and MK7) may be useful in this regard. However, since microfractures are a component of BRONJ pathogenesis and only MK4 has been shown to reduce fractures it thus represents the leading therapeutic candidate for preventing and treating osteoporosis and BRONJ.

(Two controlled studies cited showed that the addition of MK-4 significantly reduced fractures. In the first the control group had a fracture rate of 30.3% while the MK-4 group had a fracture rate of 10.9%. In the second study, the group treated with MK-4 had 86% fewer nonvertebral fractures and 87% fewer hip fractures.)

Importantly, in this study there were no differences in the number of falls sustained in the treatment group compared to the control group. Thus, it is concluded that MK4 reduces fractures independent of the number of falls someone sustains. The importance of this cannot be underestimated, since falling is the number one cause of osteoporotic fractures and subsequent death. This decrease in fractures, independent of the number of falls someone sustains, is likely due to MK4 stimulating collagen production in bone and not simply adding calcium to bones. Collagen provides flexibility to the bone, while calcium provides rigidity. When someone falls, collagen allows the bone to absorb and disperse the force of the fall without breaking.

MK4 has also been shown to stop and reverse bone loss, and reduce fracture risk, from medical conditions and medications. In clinical trials MK4 (45 mg daily) prevented bone loss and/or fractures caused by corticosteroids (eg, prednisone, dexamethasone, prednisolone), anorexia nervosa, cirrhosis of the liver, osteoporosis, menopause (estrogen deficiency), disuse from stroke, immobilization (eg, extended illness, hospitalization), Parkinson disease, phenytoin therapy, testosterone deficiency (eg, aging, prostate cancer treatment), primary biliary cirrhosis, leuprolide treatment (for prostate cancer), and other diseases and medications.

Collagen degradation is important in the pathogenesis of osteoporosis and likely plays a pivotal role in the etiology of BRONJ as well. Studies from the medical literature support the safety and efficacy of MK4 as a potential therapeutic agent in preventing and treating osteoporosis and BRONJ and should be the subject of future research.

(I found this article fascinating, appropriate, and extremely important, for both the patient and health practitioner. It not only demonstrates the importance of collagen in bone strength/elasticity, but demonstrates that a drug being prescribed for the treatment of osteoporosis could have serious side-effects with bone in another part of the body - the jaws.

It also demonstrates the benefits of adding MK-4 to any treatment program for osteoporosis, traditional or alternative. I should also mention that the study indicates that taking MK-4 can also negate the effects of other drugs that can cause bone loss - see drug section above.

*(This study is the first place I introduce vitamin K2 as an alternative treatment for osteoporosis. It has been extensively studied for its ability to promote bone density, collagen production, bone flexibility, and to decrease the risk of fractures.

In a following segment; Treating Osteoporosis with Nutritional Supplements I'll discuss the benefits of including K2 supplements with any treatment.)

Treating Osteoporosis with Nutritional Supplements

In researching the various treatment options I discovered that there are many ways, both alternative and traditional, to treat osteoporosis. In my opinion, the various options are directly related to the severity of the osteoporosis. Like most serious health issues, if caught early, treatment options could be more alternative than if they were more advanced - often involving the addition of a more extensive traditional intervention.

My conclusion is that there isn't an either/or way of treatment, but that a number of treatment options can be initiated at the same time. While I've seen evidence that the early stages of osteoporosis will respond more readily to various supplements and weight bearing exercise programs, there is certainly a place/time for simultaneous traditional treatment with pharmaceuticals/drugs.

I recommend that you defer to your health practitioner for the best form, and dosage, of any of the supplements I discuss.

Prevention

I believe this would be a good place to emphasize the importance of prevention in regard to osteoporosis. As you've read, there are many other contributing factors to osteoporosis than age. You will also learn that there are many natural/alternative ways to help treat osteoporosis.

From my observations I would recommend that women and men, with numerous risk factors for osteoporosis, should initiate safe weight bearing exercises and supportive supplements long before they reach the age when testing for osteoporosis is recommended. I also encourage those who are in the high risk category to undergo testing earlier than is traditionally recommended. Of course this is something you should discuss with your health practitioner.

Treating Osteoporosis with Nutritional Supplements

My evaluation of the available research has shown that most alternative approaches to treating osteoporosis include a good diet and supplements. While there are variations on this theme, they primarily consist of adding sufficient amounts of calcium and vitamin D3 to the diet.

However, more recent studies have shown that if you want to increase both bone density and bone strength/flexibility, it isn't enough to just increase the intake of calcium (or provide better forms of bioavailable calcium) along with adding vitamin D3 (and adequate sunlight).

These studies have shown that not only is it essential to supplement with calcium and vitamin D3, but that the program should also include vitamin K - in the K2 forms of MK-4 and MK-7. There is more than one form of vitamin K2 and I will present the research that demonstrates the importance and value of adding them to any program (alternative or traditional) attempting to successfully treat osteoporosis.

Calcium

There are many different kinds of calcium supplements available but they all aren't equal in the amount of calcium they provide, and more importantly, in how much of it is assimilated into the body from the intestine. It's a mistake to think that what you put into your mouth is completely assimilated into the body. In fact, some calcium supplements are more readily assimilated (bioavailable) than others. Here is a link to a good website page that helps explain the different forms of calcium available.
http://www.advocatehealth.com/bromenn/documents/orthopedics/Types%20of%20Calcium.pdf

Another very informative website that deals with many other aspects of calcium is
http://ods.od.nih.gov/factsheets/Calcium-HealthProfessional

There is another form of calcium that is recommended, called Microcrystalline Hydroxyapatite Concentrate (MCHC). It is produced from bovine bone and contains all of the minerals and other components of bone. Basically the source of this supplement is bone.

This website gives a good description of MCHC
http://www.metaehealth.com/site/office/article.jsp?path=fm_wellness_center/nutrition/nutritional_health_encyclopedia&id=53&category=nutrition#concentrate

The form of calcium my wife is presently using is called EZorb and was recommended by her health practitioner. One of the benefits of using it is that the company claim that it's absorbtion rate is higher than any other calcium product, between 92-95%. Here is a link to its website,
http://www.ezorbcalcium.com

Vitamin D3

Vitamin D3 helps regulate the blood levels of calcium and phosphorus and plays a major role in helping the body absorb calcium. The form of vitamin D that is most effective for humans is vitamin D3. Exposure to sunlight is critical for the body to convert vitamin D to its functional/bioactive D3 form.

The consensus is that you would need to be exposed to sunlight for at least 10 minutes a day on your arms, legs, and face, at least 3 days a week, to allow the UV light from the sun enough time to convert the vitamin D in the skin to its active D3 form.

Studies have also indicated that many more people are deficient in vitamin D than previously thought. http://www.webmd.com/vitamins-supplements/ingredientmono-929-vitamin%20d.aspx?activeingredientid=929&activeingredientname=vitamin%20d

There are a number of tests available to determine the ideal levels of vitamin D in your blood but the most commonly recommended one is called a 25-hydroxy vitamin D (25 (OH) D) blood test.

I have included some links to sites that discuss it. Utilizing the available tests for osteoporosis is one I'd leave up to your health practitioner - as he/she will be familiar with the specific test and how to evaluate it.
http://www.vitamindcouncil.org/about-vitamin-d/testing-for-vitamin-d/#
http://www.livestrong.com/article/293792-how-to-test-for-vitamin-d-d3-deficiencies

Vitamin K (I've expanded this section because of the importance I place on the role the K vitamins play in treating osteoporosis. I'm also including it because **not every** health practitioner will be familiar with the role this vitamin family plays in treating osteoporosis.)

The vitamin K family consists of a number of similar fat soluble vitamins. Vitamin K is broken down into two main groups (also referred to as vitamers), vitamin K1 and vitamin K2. The K vitamins function as essential co-factors/enzymes. Vitamin K1 is essential for blood clotting and some forms of vitamin K2 are necessary to stimulate the production of certain proteins that can bind calcium and phosphorous to the bone collagen matrix.

Vitamin K1
Vitamin K1 is the best known of the K vitamins and is commonly referred to as vitamin K - so when you read vitamin K - it is actually vitamin K1, (or phylloquinone). The primary dietary source of it is from plants, mainly green leafy vegetables, because vitamin K1 is directly involved in plant photosynthesis. Vitamin K1 is the form of vitamin K that is most directly involved in blood clotting.

***Vitamin K2**
Vitamin K2 includes a number of related vitamer sub-types. The generic scientific name for all of the various vitamin K2 forms is menaquinones. The various vitamin K2 forms are further divided into MK-n.

- Where the M stands for menaquinone;
- the K stands for vitamin K2;
- and the - n represents the specific chemical side-chain (1,2,3,4,5,6,7, etc.).

As you see, there are a number of these MK-n forms of vitamin K2 but the ones that are specifically related to osteoporosis treatment are the MK-4 and MK-7 forms. These two are the only ones I'll discuss here. (Of note here is that even though the K2 family is referred to as menaquinone - only the MK-4 version has its own name, menatetrenone.) It isn't my intention to get too scientific here but this distinction is important when you look at the studies related to the K2 family of vitamins. You can always defer to your health practitioner for an explanation.

I found this website to be a good source of information about vitamin K and its vitamers.
http://en.wikipedia.org/wiki/Vitamin_K

MK-4 - Menaquinone-4 (also known as menatetrenone)
MK-4 is closely related chemically to K1 and some can be produced from K1 within the body. The conversion takes place primarily in the pancreas, blood vessel walls, and the testes. The primary food source of MK-4 for humans is from animal products, particularly fatty components. It is also available as a supplement.

Controlled clinical trials have demonstrated the ability of MK-4 to increase bone mass density and bone strength and decrease fractures. *I'm emphasizing this section on vitamin K2 because I personally believe that vitamin K2 (in both the MK-4 and MK-7 forms) are the missing links*

when alternatively attempting to treat osteoporosis with supplements. Some of the studies that prove that will be included later.

MK-7 - Menaquinone-7
MK-7 is not produced by the body or by animals. It is produced by fermentation of certain vegetables, particularly a soy product called natto, along with sauerkraut, cheese, and kefir. MK-7 consumption has also been shown to increase bone mass and reduce the risk of bone fractures.

*In looking at the food sources of these two K2 vitamins, what struck me was that vegetarians (who are not supplementing with MK-4) will almost certainly be deficient in this form of K2. While they would be able to clot effectively, a deficiency in MK-4 could have a major impact on bone density and strength.

I've no doubt that if an appropriate study was done it would find that long-term vegetarianism would be another significant risk factor in osteoporosis - particularly because of a deficiency in the MK-4 form of vitamin K2. In addition, I believe that those whose diets do not contain fermented soy, or other fermented products, would also tend to be more deficient in MK-7 - whether they are vegetarians or not.)

(Studies also show that MK-7 is also produced by bacteria found in the intestine but as it is used by the bacteria for anaerobic respiration it isn't released by the bacteria and thus isn't absorbed from the intestine.)

Toxicity
No toxicity to MK-4 or MK-7 has been shown, even at much higher therapeutic dosages. Therapeutic dosages are those that go far beyond what is considered to be a recommended daily amount. Studies have shown that these 2 forms of vitamin K2 do not interfere with those taking anticoagulant medications, such as warfarin.

New studies are always being done so if you are taking an anticoagulant it would be prudent to consult with your health care practitioner before taking higher dosages of MK-4 or MK-7.

Role of Vitamin K2 (MK-4 and MK-7) in Bone Health
Both MK-4 and MK-7 have been demonstrated to stimulate osteoblasts - which promote bone formation - and to inhibit osteoclasts from breaking down bone. The following studies explain how Vitamin K2 (as MK-4 and MK-7) functions in supporting bone health. They are fairly technical and where I feel it necessary I will indicate the relevant portion of the study in red, or an interpretation in parentheses ( ) at the end of the Abstract. If necessary, you can also ask your health practitioner to help you interpret them.

Studies Utilizing MK-4 and MK-7
I found that there still isn't a consensus about what form of vitamin K2 is the most effective in treating osteoporosis. Most of the studies I've seen use K2 in the MK-4 form, along with calcium and D3. I will cite studies using both forms. You and your health practitioner can then decide on what would be best for you.

There have been some remarkable studies about the positive effect of the two forms of vitamin K2 in treating osteoporosis. Most of these studies were done in Japan and Asia where the concern about osteoporosis is high. In fact, the Health Science Authority in Singapore approved

a health supplement that contains vitamin K2 (as MK-7) and vitamin D3 for increasing bone mineral density. The use of MK-4 (45 mg daily) has been approved by the Ministry of Health in Japan since 1995 for the prevention and treatment of osteoporosis.

Where possible I will separate the studies based on the form of K2 used and include a brief summary. I found that in most studies, the use of the term K, or K2, means the study used the MK-4 form. The website address of the study will also be included so you, and your health practitioner, will be able to access each study listed.

(Of interest is that, of the studies that gave the dosage of Vitamin K2, each was significantly higher than what is normally recommended in the human diet by governmental regulatory agencies. More importantly, none of the levels used in the studies were shown to be toxic and didn't interfere with the blood clotting mechanism.)

I've provided a list of studies demonstrating the positive effect of using both forms of vitamin K 2. This list is found at the end of the paper in the Appendix. I believe that the K2 supplements play an essential role in treating osteoporosis alternatively. Thus, I encourage you to review them as I know your health practitioner will find them of value in designing a treatment plan for you.

Effect of Lower Dosages of MK-4

Many of the studies I've cited used much higher levels than are normally recommended for MK-4. I've not seen a consensus minimal daily recommended dosage for MK-4. Everything I did see was in mcg range (microgram) (1000 micrograms equal 1 milligram). Most recommendations fall into the 3-400 mcg range.

The majority of the studies shown previously used 45 mg of MK-4 and the results were not only very impressive but there were no side-effects noted at that dosage. There is, in my opinion, a big difference in the maintenance dosage and a therapeutic dosage. Vitamins/supplements are designed to prevent problems from occurring. Once a health issue related to a vitamin deficiency has manifested itself, maintenance levels are no longer adequate. To heal the damage done from such a deficiency, higher dosages are needed.

Given the discrepancy between the recommended daily dose and the therapeutic dose, I was curious to see if there were studies showing positive effects using a lower dosage of MK-4 than the studies - but higher than the much lower daily recommendations. I did find one that was useful.

Effect of low dose vitamin K2 (MK-4) supplementation on bio-indices in postmenopausal Japanese women.

http://www.ncbi.nlm.nih.gov/pubmed/19352059

It has been reported that treatment with a pharmacological dose (45 mg/d) of menaquinone-4 (MK-4) prevents bone loss in postmenopausal women. However, it is not known whether supplementation with low dose MK-4 has beneficial effects on bone metabolism in healthy women. The aim of this study is to examine the effects of the supplementation of 1.5 mg/d MK-4 for 4 wk on bone and lipid metabolism in healthy postmenopausal Japanese women.

These results suggest that supplementation with 1.5 mg/d MK-4 accelerated the degree of OC gamma-carboxylation. The concentrations of serum lipids and other indices were not different between the groups at either intervention period. Thus, the additional intake of MK-4 might be beneficial in the maintenance of bone health in postmenopausal Japanese women. (While this

study was done on postmenopausal women without osteoporosis it does indicate that the osteocalcin levels were increased at that dosage.)

I don't believe that daily 'maintenance' levels of MK-4 in micrograms would be adequate for treating existing osteoporosis or even osteopenia. I believe that for those who are at a higher risk of osteoporosis, the daily dosage of MK-4 should be significantly higher than the daily recommended dose. In addition, I feel that supplementing with K2 should be considered as a preventive treatment for anyone who has any of the risk factors for osteoporosis, but has not yet been diagnosed with osteoporosis.

My Opinion on Treating Osteoporosis with Vitamin K2
Others may draw a different conclusion but, based on the studies I found, we decided to include MK-4 and MK-7 to my wife's supplementation program. The studies I presented made it obvious to us that supplementing with vitamin K2 is a missing ingredient when treating osteoporosis in a more holistic, alternative way.

Vitamin K2 is not a drug. There appear to be no known side-effects (even at higher therapeutic doses), and the results of numerous scientific studies are very positive. I'm convinced that adding vitamin K2 supplementation would be beneficial to anyone with osteopenia/osteoporosis.

I would recommend it even when undergoing traditional treatment - with the consent of your health practitioner of course.

Traditional Treatment Options

Hormone Replacement Therapy
This website provides a very good introduction to hormone replacement treatment designed to replace the loss of estrogen. http://www.osteoporosis.ca/osteoporosis-and-you/drug-treatments/hormone-therapy

If you are considering this approach I encourage you to research it and go over the pros and cons with your health practitioner. (As I mentioned previously, Hormone Replacement Therapy (HRT) is known to increase the risk of breast cancer, especially if there is a family history of it.)

Fosamax
My wife used Fosamax for several years to treat her osteoporosis in its early stages. Taking it did stabilize her bone loss but then her health practitioner informed her of studies that showed some potentially serious side effects. Her doctor's initial concern was that the use of Fosamax was conclusively linked to osteonecrosis of the jawbone (A study that shows the connection between Fosamax and osteonecrosis has been discussed previously.)

Again, my wife's decision to stop taking Fosamax was based on her health practitioner's suggestion and our research but our decision should not affect your decision. There are a number of websites that deal with this and I found this one to be very good, http://www.drugwatch.com/fosamax

Forteo
Fortunately my wife is being treated by a number of excellent health practitioners. When her latest DEXA scan results were evaluated it was recommended that she start taking Forteo.

Given her DEXA levels she seriously considered using Forteo as a traditional treatment for her osteoporosis. We both spoke to her osteoporosis doctor and attended a class explaining the benefits, use and application of Forteo. I also did extensive research on it.

Because it mimics a naturally produced hormone, parathyroid, we considered it safer than other pharmaceutical drugs used today for treating osteporosis. Even though the parathyroid hormone will normally cause bone to breakdown, it is also known to help build up bone when given in the proper dosage and at specific times.

The only reason my wife did not begin treatment with it was that she wanted to incorporate all of the alternative treatments that we learned were available; including supplements, and a specific exercise program that includes, balancing, strengthening, yoga, and weight bearing.

Depending on the outcome of the present program she still may take Forteo at some point. In consulting with one of her health practitioners she decided to follow her new program for 2 years, monitoring it yearly with a DEXA scan.

I am not going to say more about Forteo here because we have not had direct experience with it. But I realize that not everyone will be able to take full advantage of alternative treatment. I also know that there will be those who can't take the supplements, or cannot afford them. If you are in this situation, and you are interested in Forteo, I encourage you to consult with your health professional and visit the Forteo website at http://www.forteo.com/Pages/index.aspx

Strontium
The doctor who recommended that my wife stop taking Fosamax (because of the possible adverse side-effects of osteonecrosis) then recommended strontium. For a period of time it appeared to be as effective as Fosamax in stabilizing her bone loss. But when the same doctor discovered that utilizing strontium over time could increase the risk of heart problems my wife decided to stop taking it.

In my research I found that this is indeed a concern. The European Medicines Agency (EMA) recommended that the use of strontium ranelate be restricted following the evaluation of data that showed an increased risk of heart problems, including heart attacks.
http://www.ema.europa.eu/docs/en_GB/document_library/Medicine_QA/human/000560/WC500142021.pdf

This same agency, in January 2014, stated that strontium ranelate should no longer be used as a treatment for osteoporosis.
http://www.ema.europa.eu/ema/index.jsp?curl=pages/news_and_events/news/2014/01/news_detail_002005.jsp&mid=WC0b01ac058004d5c1

My wife decided to stop taking strontium to treat her osteoporosis based on her doctor's recommendation. Subsequent research convinced her that doing so was the right decision. But again, this is a decision she made and is not intended to suggest that others should stop using it. In fact, there is still some controversy around strontium and there are websites that promote it - and others that don't.

Weight Bearing and Balancing Exercises

There is no doubt that any treatment of osteoporosis will require safe and effective supplementation, and possibly pharmaceutical drug intervention. But even the best nutritional

support possible is not a substitute for a well-designed weight bearing program and ideally they should go hand in hand. (Of course there are exceptions for those who are unable to participate in a weight bearing program.)

After extensive research into and evaluation of weight bearing and balancing programs we found a website (and a person) who definitely stood out among the rest. I will not attempt to repeat what Sherri Betz (PT) has to offer because she does it so well on her website and in her books.

In my opinion she has an excellent understanding of osteoporosis and this knowledge makes her program even more effective. This understanding has led her to look at the big picture when devising an exercise program for those with osteoporosis. It includes exercises for weight bearing, balancing, posture, Pilates, yoga, and cardiovascular.

While I know there are other exercise programs for osteoporosis, our recommendation is based on personal experience as my wife has had an evaluation with Sherri along with a number of personal consultations. I was present for them and was extremely impressed with her knowledge and experience and found her to be a wonderful teacher. Zoe is presently participating in her osteoporosis program.

She offers a number of Bone-Safe Yoga for Osteoporosis videos and Safe Yoga for Bone Health classes. Sherri is a Physical Therapist and advanced Pilates instructor in safe exercise programs for those with osteoporosis and has a directory of those she has personally trained to work with clients with osteoporosis. You can access Sherri's website at www.therapilates.com. It will provide you with her contact information and access to her many books & videos, including The Osteoporosis Exercise Book.

Other Books for Yoga and Osteoporosis

Yoga for Osteoporosis
Loren Fishman, MD and Ellen Saltonstall
http://yogauonline.com/yogaspirit/yoga-for-osteoporosis-new-courses/index.html

When to Go Traditional, Alternative, or Both

There isn't a consensus as to what type of treatment should be initiated. More often than not, for the patient, it is an either/or treatment situation, traditional (orthodox), or alternative. That need not be the case.

By now you should have enough information to understand that each situation is different. In some cases it is possible that an alternative treatment alone will be sufficient - particularly if the diagnosis is osteopenia, or early osteoporosis. As osteoporosis advances it could be necessary to introduce traditional treatment options - but I've not seen any evidence that would preclude using alternative and traditional treatments simultaneously.

Summary

Writing this has been a great learning experience for me. Like everyone, I'd heard about osteoporosis but, even given my dental/science background, I knew nothing about it.

When my wife was confronted with this problem I, as a writer and researcher/educator, took on the responsibility of finding out as much as I could about osteoporosis, with the specific intention of finding the best way for my wife to treat it - in the most healthy and effective way possible.

At this point I feel it would be appropriate to summarize the article and to emphasize what I believe to be the most important components. These are:

- Be proactive. You've read what I've presented but don't just take my word for it. Do your own research if you question anything I've presented. But don't wait for the answers to come to you, or wait until you already have osteoporosis to get involved.

- Get tested for osteoporosis early - don't wait. Given the many factors that can contribute to osteoporosis I don't think it is prudent for a woman to wait until she is menopausal, or even over 50. Review the risk factors I've presented and decide if you should be tested and when. Your Doctor isn't clairvoyant and, given the fact that the signs and symptoms of osteoporosis aren't obvious in its early stages, you are responsible for providing your health practitioner with this information.

- Spread the word to family and friends whom you feel may be at risk for osteoporosis

- If you've been diagnosed with osteoporosis there are some important questions to ask yourself. Have you participated in;

    - an alternative supplementation program? By this I mean have you tried taking supplements to treat your osteoporosis?
    - a complete exercise program?

You will have to be honest here. I don't mean if you are somewhat active, or have casually participated in such programs. I mean have you consistently participated in both a sound exercise program for at least one year - and two years would even be better. Once you review what a viable osteoporosis exercise program is you'll know if you have or have not been participating.

But as I've said, everyone dealing with osteoporosis is unique. No one size fits all. The program my wife chose may not be the best one for you. Thus, any decisions regarding any form of treatment, traditional or alternative, should be made with the input of your health practitioner.

What I've presented in this article is only meant as a guide for those who have been diagnosed with osteoporosis - and for those who wish to prevent it. I want to be perfectly clear that it is not meant to diagnose or recommend a treatment program for anyone dealing with osteoporosis. But I encourage you to consider this information - along with the resources I provided - and use it (along with input from your health practitioner) to make your own decision about how to best treat this condition.

We both wish you the best and hope that what we've presented here will have value.

Supplement Schedule Chart*

I have included a Master Supplement Schedule Chart that lists the 4 osteoporosis supplements that my wife is taking at the time I wrote this article, the amount, and when she takes them. In addition she takes other supplements for general health maintenance – these are not included

in the chart so that you can create your own personalized list . I have included a Blank Supplementation Schedule Chart for this purpose. These are included as attachments to the email and you can open them and print them out.

One of the most important aspects of any health/healing program is compliance. If you aren't motivated to be consistent with a program you cannot expect positive results. These Supplement Schedule Charts are designed to help you comply with the program you set up by allowing you to keep track of the supplement/pharmaceuticals you are taking and when to take them.

The most effective way to use them is to print out a master copy and keep it separate so you'll be able to make additional copies from it as needed. Each Supplement Schedule Chart records one week of the program.

We did not include most of the brand names of the supplements in the chart. This is because they may change as we learn something new and we also felt that you and your health practitioner will have thoughts on which brands and which specific supplements to take. The supplements we've listed are available from your local health food store, your health practitioner, or from online vitamin stores.

Note: In regard to MK-4. It is available in liquid or capsules. My wife introduced it by taking 15mg a day for one week, increasing it to 30mg a day for the second week and upping it to 45mg a day the third week. She uses the liquid form and now takes 15mg of MK-4 three times a day.

Appendix

Studies Utilizing MK-4 and MK-7

Vitamin K (K2) and bone health.
http://www.ncbi.nlm.nih.gov/pubmed/15018483
Vitamin K, originally recognised as a factor required for normal blood coagulation, is now receiving more attention in relation to its role in bone metabolism. Vitamin K is a coenzyme for glutamate carboxylase, which mediates the conversion of glutamate to gamma-carboxyglutamate (Gla). Gla residues attract Ca2+ and incorporate these ions into the hydroxyapatite crystals. There are at least three Gla proteins associated with bone tissue, of which osteocalcin is the most abundant and best known. Osteocalcin is the major non-collagenous protein incorporated in bone matrix during bone formation. However, approximately 30% of the newly-produced osteocalcin stays in the circulation where it may be used as an indicator of bone formation.

Vitamin K (K2) deficiency results in an increase in undercarboxylated osteocalcin, a protein with low biological activity. Several studies have demonstrated that low dietary vitamin K (K2) intake is associated with low bone mineral density or increased fractures. Additionally, vitamin K (K2) supplementation has been shown to reduce undercarboxylated osteocalcin and improve the bone turnover profile. Some studies have indicated that high levels of undercarboxylated osteocalcin (as a result of low vitamin K2 intake?) are associated with low bone mineral density and increased hip fracture.

(My summary: Certain K2 vitamins stimulate osteoblasts to produce a number of bone proteins (called GLA proteins), the most abundant one being osteocalcin. Osteocalcin is then incorporated into the bone collagen matrix and it is on specific osteocalcin sites that the Ca++

ion attaches to. If enough osteocalcin is produced 30% stays in the blood where it can be used as an indicator of adequate bone formation. If it isn't fully converted (because of a deficiency of K2) it will be found in the blood as undercarboxylated osteocalcin. The blood can be tested for this form and if higher levels of it are found it is associated with low bone mineral density and is an indicator of a higher risk for bone fractures.)

Studies Using MK-4

Vitamin K2 as MK-4, but not as MK-7 has also been shown to prevent bone loss and/or fractures in the following circumstances: postmenopausal osteoporosis.

Vitamin K supplement along with vitamin D and calcium reduced serum concentration of undercarboxylated osteocalcin while increasing bone mineral density in Korean postmenopausal women over sixty-years-old.
http://www.ncbi.nlm.nih.gov/pubmed/21860562

The vitamin K group (vitamin K + vitamin D + calcium supplement; 15 mg of vitamin K2 [MK-4) [menatetrenone] three times daily, 400 IU of vitamin D once a day, and 315 mg of calcium twice daily, and the *control* group (Vitamin D once a day and 315 mg of calcium twice daily) were randomly assigned. In a per protocol analysis after 6 months, L3 bone mineral density has increased statistically significantly in the vitamin K group compared to the control group with just Vita D and calcium. In conclusion, addition of vitamin K to vitamin D and calcium supplements in the postmenopausal Korean women increase the L3 BMD and reduce the undercarboxylated osteocalcin UcOC concentration. [The vitamin K group undercarboxylated osteocalcin was significantly reduced and the bone mass density of L3 was increased when compared to the study group.]

A longitudinal study of the effect of vitamin K2 on bone mineral density in postmenopausal women a comparative study with vitamin D3 and estrogen-progestin therapy.
http://www.ncbi.nlm.nih.gov/pubmed/10227010
Vitamin K2 (as MK-4) suppressed the decrease in spinal BMD as compared with no treatment group. BMD in women treated with vitamin K2 was inversely correlated with their age ($r = -0.54$; $P < 0.05$). Vitamin K2 therapy may be a useful method for preventing postmenopausal spinal bone mineral loss. In addition, the therapy should be started early in postmenopausal period.

Vitamin K and the prevention of fractures: systematic review and meta-analysis of randomized controlled trials.
http://www.ncbi.nlm.nih.gov/pubmed/16801507
This systematic review suggests that supplementation with phytonadione and menaquinone-4 {MK-4} reduces bone loss. In the case of the latter, there is a strong effect on incident fractures among Japanese patients. [MK-4 supplementation reduces bone loss and reduces fractures.]

Effect of combined administration of vitamin D3 and vitamin K2 on bone mineral density of the lumbar spine in postmenopausal women with osteoporosis.
http://www.ncbi.nlm.nih.gov/pubmed/11180916
The effect of the combined administration of vitamin D3 and vitamin K2 on bone mineral density (BMD) of the lumbar spine was examined in postmenopausal women with osteoporosis. (This study included 4 groups. One with just Vitamin D3. One with MK-4. One with vitamin D3 and MK-4, and one with just calcium (as calcium lactate). The group with both vitamin D3 and MK-4 fared the best at increasing bone mass density of the lumbar spine. These findings indicate that combined administration of vitamin D3 and vitamin K2, compared with only calcium

administration, appears to be useful in increasing the BMD of the lumbar spine in postmenopausal women with osteoporosis.

Vitamin K2 treatment for postmenopausal osteoporosis in Indonesia.
http://www.ncbi.nlm.nih.gov/pubmed/16594930
To investigate the effect of vitamin K2 (menatetrenone) treatment on bone mineral density (BMD) and a bone metabolic marker (osteocalcin) in postmenopausal women with osteoporosis living in Indonesia. Treatment with 45 mg vitamin K2 with 1500 mg calcium per day for postmenopausal women with osteoporosis for 48 weeks resulted in a significant increase in lumbar BMD and a significant decrease in undercarboxylated OC levels.

Vitamin K2 (menatetrenone) effectively prevents fractures and sustains lumbar bone mineral density in osteoporosis.
http://www.ncbi.nlm.nih.gov/pubmed/10750566
We attempted to investigate whether vitamin K2 (menatetrenone) treatment effectively prevents the incidence of new fractures in osteoporosis. Furthermore, vitamin K2 treatment enhances gamma-carboxylation of the OC molecule. These findings suggest that vitamin K2 treatment effectively prevents the occurrence of new fractures.

Effect of continuous combined therapy with vitamin K(2) and vitamin D(3) on bone mineral density and coagulofibrinolysis function in postmenopausal women.
http://www.ncbi.nlm.nih.gov/pubmed/11886767
To investigate the therapeutic effect of combined use of vitamin K(2) and D(3) on vertebral bone mineral density in postmenopausal women with osteopenia and osteoporosis. Combined therapy with vitamin K(2) and D(3) for 24 months markedly increased bone mineral density (4.92 +/- 7.89%), while vitamin K(2) alone increased it only 0.135 +/- 5.44%. Continuous combination therapy with vitamin K(2) and D(3) may be useful for increasing vertebral bone mass in postmenopausal women. Furthermore, the increase in coagulation function observed during this therapy was within the physiological range, and no adverse reactions were observed. (Along with the findings that MK-4 markedly increased bone mineral density, a key element of this study was that it showed that the use of K2 effect on coagulation was within the normal range.)

Menatetrenone (MK-4) and vitamin D2 with calcium supplements prevent nonvertebral fracture in elderly women with Alzheimer's disease.
http://www.ncbi.nlm.nih.gov/pubmed/15664003
A high incidence of fractures, particularly of the hip, represents an important problem in patients with Alzheimer's disease (AD), who are prone to falls and may have osteoporosis. We previously showed deficiency of vitamins D and K1 causes reduced bone mineral density (BMD) in female AD patients. The present study was undertaken to address the possibility that treatment with vitamin K2 (menatetrenone; MK-4) may maintain BMD and reduce the incidence of nonvertebral fractures in elderly female patients with AD. Treatment with MK-4 and vitamin D2 with calcium supplements increases the BMD in elderly female patients with AD and leads to the prevention of nonvertebral fractures.

MK-7 Studies Showing Positive Effect on Preventing Bone Loss & Increasing Bone Growth

Effect of vitamin K2 (menaquinone-7) in fermented soybean (natto) on bone loss in ovariectomized rats.

http://www.ncbi.nlm.nih.gov/pubmed/10084398
This study demonstrates that the intake of dietary MK-7 has a preventive effect on bone loss caused by ovariectomized (OVX) rats. This study demonstrates that the intake of dietary MK-7 has a preventive effect on bone loss caused by OVX. This effect may be partly caused by MK-4, which is formed by degradation of MK-7.

Regulatory Mechanism of food Factors in Bone Metabolism and Prevention of Osteoporosis
https://www.jstage.jst.go.jp/article/yakushi/126/11/126_11_1117/_article
Aging induces a decrease in bone mass, and osteoporosis with its accompanying decrease in bone mass is widely recognized as a major public health problem. Bone loss with increasing age may be due to decreased bone formation and increased bone resorption. Menaquinone-7 (MK-7), an analogue of vitamin K_2 which is abundant in fermented soybeans, has been demonstrated to stimulate osteoblastic bone formation and to inhibit osteoclastic bone resorption.

Studies on action of menaquinone-7 (MK-7) in regulation of bone metabolism and its preventive role of osteoporosis
http://onlinelibrary.wiley.com/doi/10.1002/biof.5520220102/abstract;jsessionid=FF2AD7A84A547ECE808F5533966D67EA.f03t01
It was found that the intake of experimental diets containing the fermented soybean (natto) with supplemental MK-7 caused significant elevations of MK-7 and γ-carboxylated osteocalcin concentration, a bio marker of bone formation, in the serum of both ovariectomized rats and normal subjects, suggesting that MK-7 may play an important role in the prevention of age-related bone loss.

*Disclaimer

I am not a medical doctor and I make no medical claims. This information is based on my personal research and is not intended to diagnose or make any specific treatment recommendations to others. I have no vested interest in any of the websites and cannot verify their accuracy. I also have no vested interest in any of the products or programs I have talked about. I've done my best to provide information that is accurate. I have included information about the program my wife is following but as every patient is unique, no attempt should be made to self-treat without a consultation with a qualified health practitioner.

*This article was written in 2015. We will continue to research this issue and when new information and treatment options are available, including the supplements and dosages, we will make the proper adjustment to my wife's program. It will be impossible to update this article and make it available to everyone who has seen it. Thus, I encourage you to actively work with your health practitioner to ensure your treatment program is up to date.

About Dr. Tom McGuire
Dr. Tom McGuire is a leading authority on mercury safe dentistry, mercury amalgam (silver) fillings, mercury detoxification, and holistic dental wellness. He has the largest website on these

subjects and the most comprehensive Mercury Safe Dentist Directory available on the Internet. You can learn more about him at his website, www.mercurysafedentists.com.

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Supplement Schedule Chart

Name: **Week Of:**

Supplement		# Taken	Dose /day	Mon			Tues			Wed			Thurs			Fri			Sat			Sun		
				B	L	D	B	L	D	B	L	D	B	L	D	B	L	D	B	L	D	B	L	D

				Mon			Tues			Wed			Thurs			Fri			Sat			Sun		

Notes:

Legend:	**bb**—before breakfast bm – between meals