Osteoporosis and Hyperkyphosis
What Does Calcium Have to Do With It?

By Ruth Werner
To complement this issue’s theme on posture, let’s discuss a common postural problem among many older Americans: the hyperkyphosis that often accompanies osteoporosis.

We in the United States have grown up under the paradigm that dairy products are an important source of calcium. Indeed, according to many resources, it would appear that dairy products are the only source of calcium American adults need (to wit: “Got milk?”). Those of us in alternative healthcare may have learned that many options to milk exist, but debate still rages over the best ones, how useful they are, and whether calcium in any form actually provides protection against osteoporosis.

I can’t give definitive answers on this topic in this limited space, but I can perhaps shed light on some organizing principles so that massage therapists (and the clients who may ask them for advice) can make informed decisions about how to prevent, slow, or manage this common and painful disorder.

Bone physiology is Wolff’s Law, which essentially says that every change in the form and/or function of a bone is followed by changes in internal and external architecture. In other words, bone is a use-it-or-lose-it proposition: weight-bearing stress sends the signal that maintaining bone density is a high priority. Lack of weight-bearing stress sends the signal that bone density is a low priority, and calcium can be spared for other purposes.

Osteoclasts and osteoblasts work under hormonal control on bone that is either dense or spongy. Dense bone, formed of concentric rings of mineral deposits, is found in the shafts of the long bones, while spongy or trabecular bone is found in the epiphyses and vertebral bodies. Trabecular bone is metabolically much more active than dense bone. It is here that new blood cells are formed and where the majority of remodeling occurs in adulthood. It is in these areas, then, that calcium deficiency has the greatest impact (see Figure 1).

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What is Osteoporosis?

Osteoporosis is a condition in which the calcium deposits in bone tissue become dangerously thin. Literally, it means porous bones. It is preceded by osteopenia: thinning bones. Both osteoporosis and osteopenia are extremely common in this country. It is estimated that ten million people have osteoporosis (eight million women and two million men), and an additional thirty-four million have osteopenia. One out of every two women, and one out of every eight men over age fifty, will have an osteoporosis-related fracture. Osteoporosis contributes to one and a half million fractures each year, and less than one-third of those patients return to pre-fracture levels of activity. 

Bone Construction

To understand the process of osteoporosis and how it leads to hyperkyphosis, we need to take a brief look at how healthy bones grow and maintain their mass. Perhaps the most important principle in understanding bone physiology is Wolff’s Law, which essentially says that every change in the form and/or function of a bone is followed by changes in internal and external architecture. In other words, bone is a use-it-or-lose-it proposition: weight-bearing stress sends the signal that maintaining bone density is a high priority. Lack of weight-bearing stress sends the signal that bone density is a low priority, and calcium can be spared for other purposes.

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Loss of key struts of trabecular bone can cause the whole structure to collapse in a spontaneous fracture. The most common locations for these injuries are the head and neck of the femur (this is the dreaded broken hip of old age), the distal forearm, and the vertebral bodies. When these crumble, this is called a compression fracture (see Figure 2, page 124). The upper and mid-thoracic vertebrae are the most likely to collapse, leading to the exaggerated kyphotic curve we often see in elderly people, especially women. The layperson’s term for this condition is dowager’s hump (see Figure 3, page 124).

The Calcium Question

So far the process of developing osteoporosis isn’t hard to understand: calcium is pulled off the bones...
faster than it is replaced, and the result is spontaneous fractures. We use calcium for many processes besides maintaining dense bones: muscle contraction, nerve transmission, blood clotting, and pH buffering, to name a few. Questions arise, however, with regard to how much calcium is the right amount, what are the best sources, and does having high bone density actually protect us from osteoporosis and spontaneous fracture? The answers are not always clear—probably because the truth lies in a combination of factors not always studied together.

**How Can We Get Calcium?**

The human skeleton increases in mineral density between conception and about age thirty, but close to 98 percent of bone mass has been acquired by about age twenty. Clearly, the time to build up deposits in our calcium bank is during childhood and early adulthood. From that time forward, we either maintain our balance or we make withdrawals to use calcium for any of its many other purposes.

We get calcium from dietary sources. Dairy products are rich in calcium, so these appear to be an efficient resource for this important mineral. Children tend to be extremely good at extracting calcium from dairy products, but adults may have a harder time for a number of reasons. Calcium requires an acidic environment for absorption; milk interferes with stomach acidity and acidity decreases with age. Many people (especially those who are not of Northern European descent) are lactose intolerant: they are missing the digestive enzyme that breaks down lactose, and so dairy products make them feel ill. Ultimately, some sources suggest that about 32 percent of the calcium in dairy products is absorbed into the bloodstream.

Proponents of a dairy-free diet suggest that “beans and greens” are a good way to supplement calcium, with absorption rates that vary between 40 and 64 percent. Many leafy vegetables are high in calcium but some (notably Swiss chard and spinach) also have substances that interfere with calcium uptake, so they are not recommended as good sources for this mineral. Other sources for calcium include dried fruits (figs especially), some nuts (including almonds), canned fish with the bones (salmon or sardines), and calcium-supplemented foods (tofu, soy, and orange juice).

If food sources are not sufficient, calcium supplements may be considered. Here again there is controversy on the best forms. One common suggestion is to avoid calcium in the form of dolomite: this has been associated with a risk of lead poisoning. Beyond that, calcium carbonate, calcium phosphate, and calcium citrate head the list for being easily absorbed. It is important to bear in mind, however, that calcium must be ingested with other substances (specifically vitamins D and K and magnesium) for best use. Some people recommend using antacids for calcium supplementation, but those that are formulated with aluminum or high levels of magnesium may have the opposite effect.

**How Do We Lose Calcium?**

Getting calcium in the mouth is only the first part of the equation. It turns out that several factors lead to the loss of calcium through sweat or urine. Some of these have to do with eating and drinking habits, but calcium loss can also be due to underlying disorders or medications.

A diet heavy in meat-based proteins and low in fruits and vegetables turns out to be a significant factor in calcium metabolism, because calcium operates as a chemical buffer to neutralize the acid by-products of protein metabolism. Caffeine is another risk factor:
drinking more than four caffeine-enhanced beverages per day has been seen to interfere with retention.7 Smoking and alcohol have also been associated with poor calcium absorption.

Many disorders and diseases lead to calcium loss. Chronic stress and depression have been seen to increase cortisol and decrease bone mass.7 Any endocrine disorder that upsets hormonal secretions (diabetes, hyperthyroidism, or Cushing disease), or digestive disorders that make it difficult to absorb nutrients (Crohn disease, ulcerative colitis, celiac disease, etc.), can be contributing factors. A history of eating disorders can change estrogen and progesterone secretion, which has impact on calcium uptake. And any cancer that influences bone marrow (leukemia, myeloma) can lead to bone thinning.

Additionally, a whole plethora of medications interfere with calcium absorption or retention. Chemotherapeutic drugs, some birth control drugs, diuretics, corticosteroids, anticonvulsants, and blood cloting drugs all influence bone density.

Finally, the hormonal changes that occur in women at menopause may be the single biggest factor in developing osteoporosis later in life. A sudden drop in secretions of estrogen and progesterone can lead to a loss of 1-5 percent of bone mass per year, for several years.9

How Does Calcium Relate to Osteoporosis?
The answers to this question are not always clear. While many studies support the relationship of high calcium diets to a reduced risk of osteoporosis, some inconsistencies continue to demand attention. Why, for instance, do some countries with much lower average calcium consumption than the United States also have lower rates of spontaneous fracture?10, 11 Why do women with low calcium diets have the same bone density as women with high calcium diets?10 Finally, increased calcium consumption in postmenopausal women does not protect them from spontaneous fracture, while it does make them more vulnerable to kidney stones.11

Again, the answers probably lie in combinations of factors that include not just how much calcium a person consumes, but what other issues (like diet and medications) influence calcium uptake. Although we have been studying osteoporosis for decades, the subtleties of this disease are just now beginning to be explored.

Will Massage Make a Difference?
Massage will probably not change calcium uptake or bone density. In the treatment of clients who have osteoporosis, the appropriateness of massage is determined by the fragility of the individual client: some will be able to take more pressure than others, obviously. The only way massage could make the situation worse would be to exert enough force to cause a fracture.

On the other hand, consider the condition of the muscles of someone with osteoporosis. The anterior muscles (anterior deltoid, pectoralis minor, scalenes, sternocleidomastoid) are tight and hard, while the posterior muscles (rhomboids, trapezius, paraspinals) are stretched and irritated. Massage can offer symptomatic relief, even if it can’t reverse the degeneration of the bone tissue. In any case, caution is the key with this condition. Don’t look for miracles; taking someone out of her pain for a few hours is miracle enough.

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Notes
4. Ibid.

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