Yoga as Therapy for Our Vital Bones

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LEARNING OBJECTIVES

1. Describe key physiological processes that contribute to bone health throughout a person's lifespan.
2. Understand common measures of osteopenia, osteoporosis, and fracture risk to help to identify safe, appropriate yoga practices for an individual.

What comes to mind when you picture your skeleton?

The model of our bones that people are most familiar with is a structure devoid of any connection to all the other tissues of our body; it is just the form on which our human suit hangs. With such a barren visual, no wonder we may have many misconceptions about how to take care of our vibrant living bones—and how to help clients do the same.

Taking a closer look at the interconnected functions of our bones, we get a better understanding of our skeleton on a deeper level. This provides insights into how we yoga teachers and therapists can employ yoga teachings and models to have the most impact on the well-being and health of clients—especially if they have osteoporosis or low bone density.

The Bare Bones About Our Bones

When we study the musculoskeletal system from a Western perspective, we learn the basic mechanics of the movement of the skeleton, muscles, and connective tissues. We recognize how the bones receive and transmit forces throughout the body, ligaments cross junctions between bones to articulate joint spaces, tendons connect muscle to bones, fascia interweaves throughout, and muscles move the bones into position to do their jobs. Some of our bones also function as shields protecting the brain, heart, lungs, and spinal cord.

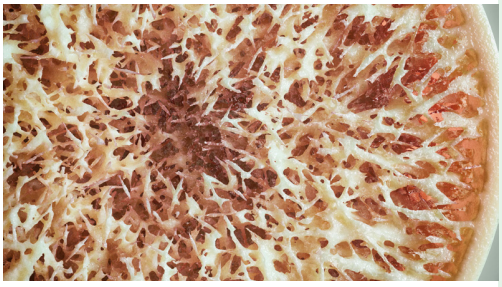
Rarely do we acknowledge that our bones are themselves complex and vital organs. They create our lifeblood and store essential

nutrients. From the bone marrow comes stem cells that create white blood cells that empower our immune system, red blood cells that carry nutrients throughout the body, and blood-clotting platelets. Our bones are also the storehouse for key minerals like calcium, magnesium, and phosphorus, to name just three that are critical to hundreds of metabolic functions and biochemical reactions.

Ayurveda acknowledges the ways our bones help nourish the body in two levels of the seven key tissues *(dhatu)*. Nourishment begins in the plasma *(rasa),* flowing into the blood *(rakta),* to the flesh *(mamsa),* through the fat *(medha),* then to the bone *(asthi),* and then further still to what is within the bones—nerves and marrow *(majja)*—and, lastly, to our reproductive tissues *(shukra)* for the deepest of vitality. Eastern and Western models of nutrition concur that when we nourish our bones, we are nourishing our bodies deeply.

Not Set in Stone

The bones we see hanging in an anatomy lab appear rigid and fixed, belying the dual qualities of strength with flexibility and density with lightness that live bones must have to be strong enough to protect yet light enough to move. These qualities come from bones' outer, dense, compact layer (cortical) combined with an inner, webbed, spongy matrix (trabecular).



To uphold the integrity of their design, bones dynamically renew on a cellular level: Worn-out bone cells are cleared away and new, vibrant bone cells are created in their place. The main mechanisms behind this process are two types of cells: osteoclasts that chew up old bone cells (resorption) and osteoblasts that build up new bone cells (deposition).

The Western Approach to Osteoporosis

The DXA Scan

The DXA scan machine entered the mainstream in the mid-1990s prompted by Merck, the makers of Fosamax (www.npr.org/2009/12/21/121609815/how-a-bone-disease-grew-to-fit-the-prescription). But general screening is not covered by Medicare and other health insurance in the United States until age 65 for women, and even then it has to be ordered by a doctor—very late in the life of our bones. A doctor may, however, refer someone for a DXA scan earlier for some other reason like a loss of height; a fracture; or to get a baseline before a medical treatment that might affect their bone health, such as some chemotherapies or rheumatoid arthritis treatments.

The scan measures the hip (femur), femoral neck, and lumbar spine (and sometimes the wrist of the nondominant hand) because these sites have the clearest view for the x-ray beam.

Bone-mineral density (BMD) is expressed in statistical units—standard deviations—that indicate how far your BMD deviates from the norm for a young adult. Below normal is indicated with a minus sign. The results read as a T-score in these ranges:

- Between +1 and –1.0 = normal bone density (higher is high bone density)
- Between –1.0 and –2.5 shows low bone density (aka osteopenia) but not osteoporosis
- –2.5 or below indicates osteoporosis

As your bone density decreases, your T-score gets lower.

Although the DXA machine generally does not measure the quality of the trabecular bone, the report includes a percentage of fracture risk as calculated by the FRAX fracture risk assessment tool. FRAX takes into account a variety of risk factors to calculate a person's chance of experiencing a fracture in the next 10 years, with results above 20% considered high risk.

Medications

Osteoporosis medications alter the natural bone remodeling system either by slowing down the osteoclasts breaking down bone (antiresorptive medications) or by boosting the osteoblasts building up bone (anabolic medications). Bisphosphonates such as Fosamax, Boniva, and Reclast are the most common antiresorptive prescriptions you'll see on client intake forms; Forteo, Tymlos, and Evenity are the most common anabolics.

Many people are absolutely set against taking bone medications and only want to take a natural approach to dealing with osteoporosis. The success of such a course really depends on their personal case: their own root cause—the factors that created the imbalance in the first place—and their ability to influence these factors, which isn't always possible.

On the flip side, many doctors prescribe bone medications to every patient they diagnose with osteoporosis, regardless of root cause.

Clients may appreciate the reassurance that taking medications and working on your overall health in a holistic manner are not mutually exclusive options. In fact, if medical treatment is warranted, complementing it with a holistic approach that focuses on diet and lifestyle will only enhance the outcome.

Throughout our lifespan this dynamic process, called bone modeling and remodeling, is at play in different ratios. In our early stages of life, ideally, the osteoblasts are outpacing the osteoclasts, building size, density, and the interior spongy matrix. This process accelerates during puberty.

We stop building out our skeleton in our late 20s to early 30s—this is all the bone mass we will have to depend on for the rest of our lives. Sadly, our personal peak bone mass is never measured at this watershed moment, nor do most of us consciously build it when we're young.

For the rest of our lives, we continue to remodel bone and keep renewing on a cellular level, as with all our tissues. And then at some point the osteoclasts naturally start to outpace the osteoblasts, although the timing and pace of this shift varies by individual given the many contributing factors that affect the balance of this cellular activity.

For women during the child-bearing years, the body prioritizes a strong skeleton. When that stage of life ends, the process shifts dramatically: At the menopause transition, while most of the headline news is on hot flashes and night sweats, women lose from 10% to 20% of their bone mass in those 5 to 6 years from the loss of estrogenic protection that inhibits osteoclast activity.[1] And bone loss continues at 0.5% per year after those first several years of menopause. For men, a steep loss of bone mass due to the aging process happens later in life, around 70.

About Low Bone Density and Osteoporosis

Osteoporosis is defined as extremely low bone density and/or weakened internal bone structure, making the bones especially vulnerable to fracture. A diagnosis of osteoporosis comes from either experiencing a low-trauma fracture (a fall from a standing height or less, which in a strong skeleton would not result in a fracture) or from a dual x-ray absorptiometry (DEXA or DXA) scan that measures the bone-mineral density (BMD) compared to the peak bone mass of an average young adult. Low bone density not yet in the osteoporosis range goes by the clinical term *osteopenia*. BMD refers to the mass of the bones; BMD combined with the quality of the trabecular bone equals the strength of the bones.

Many variables contribute to the interplay of osteoblasts and osteoclasts in affecting the strength of the bones. Many of these forces take place on a physiological level, unknown to our conscious minds as they silently affect the bone remodeling balance.

- **Exercise and movement:** Bones respond to gravitational forces. Astronauts lose about 1% of their bone mass for every month they are in a zero-gravity environment.[2] Here on Earth, whether we have an active or a sedentary lifestyle greatly affects the remodeling of our bones. Plus, as we age, the loss of bone is accompanied by the loss of muscle mass, *sarcopenia*. Muscle mass begins to decline at 1% per year after age 50. And current research shows that muscle-bone communication stimulates the strength and viability of both tissues.[3]
- **Diet:** Poor nutrition depletes the body of bone-building nutrients like calcium, protein, and fats that carry fat-soluble vitamins such as A, D, E, and K into the body. The effects of a poor diet on the gut also inhibit overall nutrient absorption and can lead to other diseases.
- **Other diseases and medications:** Osteoimmunology studies the two-way communication between the skeletal and immune systems. Oxidative stress and chronic inflammation are the hallmarks of any chronic disease state, and osteoporosis is no exception. Risk factors for osteoporosis can also come from other diseases or the medications taken to manage them. For example, hyperparathyroidism affects the metabolism of vitamin D, which is essential for bone building and maintenance. Celiac and Crohn's are examples of diseases that compromise the absorption of nutrients. Autoimmune conditions such as rheumatoid arthritis are treated with high doses of prednisone, one of dozens of pharmaceuticals known to have a negative effect on bone structure.
- **Stress:** Chronically elevated cortisol increases bone resorption and interferes with bone building. Stress also affects our breathing rate, which in turn affects our blood pH and our metabolism. The calcium that bones store is key to maintaining normal blood pH, which lies within a narrow range.
- **Smoking:** Smoking reduces the blood supply to many tissues, including the bones, decreasing the body's ability to absorb calcium. Nicotine also slows production of osteoblasts.
- **Alcohol:** Having more than two or three drinks a day affects how the body absorbs calcium via the intestines and how it metabolizes vitamin D through the pancreas.
- **Genetics:** Whether your parents have ever had a fracture matters, as genetic factors account for 50%–85% of our BMD and fracture risk.[4]
- **Sex:** Women tend to get osteoporosis more often than men because of the effects of reduced estrogen as they age. Estrogen inhibits osteoclast activity, and women are more susceptible to or likely to experience endocrine disruptors such as pregnancy, menopause, amenorrhea, anorexia, and environmental toxins—all of which can disturb the body's estrogen levels.
- **Age:** Age is considered a primary cause of osteoporosis simply because the condition tends to manifest at a later age.

Low BMD results from an extended state of imbalance with one or many of these contributing factors that have triggered too much osteoclast activity, not enough osteoblast activity, or both.

Clients with this condition may ask if osteoporosis can be reversed. Although we can't turn back decades, we can stabilize the remodeling system. But it's not simple or straightforward. No single

Assessing a Client's Fracture Risk

The biggest concern we have for clients is to help them avoid bone fractures. Knowing a client's fracture risk informs the practices we co-create with them and ensures appropriate caution.[5]

To assess a client's fracture risk at a minimum ask them: "Have you had a fracture after age 40?"

- A vertebra or hip fracture places that person at high risk of another fracture in the next 10 years.
- A wrist-only fracture places the person at a moderate risk.

A fracture trumps any DXA score, even if someone is only in the osteopenia range. But note that vertebral fractures can go unnoticed. Some signs of vertebral fracture are a loss of 1.5 or more inches in standing height, a decrease in the space between ribs and hips to less than three fingers' width, and an excessive kyphotic curve in the upper spine.

Note that fracture risk can change over time. Clients can potentially lower their risk by making changes with lifestyle factors or health conditions and risk of falls, or their fracture risk could increase if their medical state changes, for instance, if they're undertaking cancer treatment.[6]

Intake Assessments and Forms

Hyperkyphosis and falling are two key factors contributing to fractures of the spine, hip, forearm, and shoulder. Assessing the client's sense of balance and overall postural alignment will help to provide measurements for yoga therapy goals and outcomes. And not to be overlooked is the power of mindset: Examples of significant positive results from yoga therapy include a client's self-reported sense of calm, ease, and confidence with their bone-health plan and their experience in everyday activities, and reporting that they did not fall when they lost their balance.

Consider incorporating these four categories into your intakes to get a better idea of the contributing factors to a client's current bone health and potential areas for improvement. Have them check all the statements that apply:

PREVIOUS FRACTURE

❑ I have broken a bone since the age of 40.
❑ I have lost more than 1.5 inches from my tallest height.

AGE/GENETICS

❑ I am 65 years or older (women) or 70 or older (men).
❑ I went through menopause (either naturally or due to surgery or other treatments) before the age of 45.
❑ I am of European or Asian origin.
❑ I have a close relative (parent or grandparent) with osteoporosis or who has broken a hip.

LIFESTYLE

❑ I smoke cigarettes.
❑ I average more than two servings of alcohol a day.
❑ I don't eat or drink dairy products.
❑ I don't take calcium supplements or eat or drink products that have calcium added to them (such as nut milks and some orange juices).
❑ I don't take a vitamin D supplement.
❑ On average I do fewer than three weight-bearing activities a week (at least 20 minutes each time).
❑ I have fallen two or more times in the past year.

HEALTH AND MEDICATIONS

❑ I weigh less than 127 pounds.
❑ I have a chronic health condition such as celiac disease, lung disease, kidney disease, rheumatoid arthritis, liver disease, inflammatory bowel disease (such as Crohn's disease or ulcerative colitis), or type 1 insulin-dependent diabetes.
❑ I take or have taken oral steroid medications (such as prednisone), proton-pump inhibitors, cancer treatments (such as chemotherapy or hormone treatments for breast cancer or prostate cancer), anti-seizure medicine, or immunosuppressive medicine.
❑ I take medicine that may cause drowsiness and dizziness or that comes with cautions against driving or operating machinery.

(Questions adapted from the United States Bone & Joint Initiative.)

thing will make the difference in our bone health—not just yoga, or weight training, or eating healthily or supplementation, and not just bone drugs or addressing underlying causes. An individual combination of all those things is required.

How Yoga Therapy Can Help

Yoga therapy can be uniquely beneficial to our bones precisely because it is a biopsychosocial-spiritual practice that approaches the human system on the five dimensions of being described in the *panchamaya* model. We can support an individual as they address their bone health on these levels:

1. anatomy *(annamaya)* by addressing the physical weight-bearing needs of the bones;
2. physiology*(praṇamaya)* by affecting the biochemical and metabolic factors contributing to bone loss;
3. thought *(manomaya)* through supporting the client's ability to focus and stay balanced both physically and mentally;
4. behavior *(vijnanamaya)* through cultivating discernment *(viveka)* in establishing healthier habits; and
5. emotions *(anandamaya)* by alleviating the stress, fear, confusion, anger, or panic—any of the negative emotions that can keep a person from taking a confident path forward.

When allopathic medical professionals suggest lifestyle changes, they may recommend calcium, vitamin D, and weight-bearing exercise. Public debates about exercise for bone health often narrowly define yoga as a series of poses and pit it against weight training and other exercise programs focusing on stimulating bone building. Unfortunately, not only does this dismiss the broader approach of yoga philosophy, which recognizes that our bones are part of a complete, interrelated, interconnected human system, it is a fallacy to think that we are solely trying to build up lost bone. Not losing any more bone is also a win. The overarching goal is to restore healthy bone remodeling.

Nevertheless, yoga's physical practices do provide a weight-bearing element. Although the results of the 2016 study "Twelve-Minute Daily Yoga Regimen Reverses Osteoporotic Bone Loss" conducted by Loren M. Fishman, MD, C-IAYT, et al., are sometimes exaggerated, one key outcome was taking yoga out of the relaxation-and-stretching category to recognize the weight-bearing aspects and the positive muscle-bone communication that poses can provide. The study included 12 poses and found that a consistent Iyengar-style practice stimulated modest but statistically significant BMD increases. Precisely aligning these postures in our body and holding them for about 30 seconds increases muscular needs and generates the intensity of compressive and tensile directional stresses on the bones, appearing to stimulate bone remodeling.

Clients likely want to know what poses they should do for the benefits or avoid for the sake of safety. But yoga and bone health is not a one-size-fits-all situation, so a simple list does not suffice. The condition of low bone density can manifest in our 40s or 50s, and we could live another 5 decades more. Each individual and each decade of life has its own capacities to take into consideration, so we must address poses on a case-by-case basis. Yoga therapists need to take into account each person's fracture risk along with their fitness level, experience with yoga, sense of body awareness, history of injuries, and myriad other conditions—not just the number from their DXA scan.

Fracturing is the main concern. With osteoporosis, low-trauma fractures at any site can occur, but hip fractures are particularly common from low-trauma falls. Statistically, breaking a hip has the greatest impact of any type of fracture on quality of life, as a quarter of all patients never fully recover.

Yoga practices can reduce the risk of fracture from falling by increasing

- strength,
- flexibility,
- proprioception and interoception,
- balance, and
- range of motion.

Practices that increase joint range of motion and build strength and flexibility throughout the body, including the feet and hands, help clients increase their sense of balance, maintain body awareness, counter frailty, and have a more open and confident gait so they're less likely to trip. Practicing barefoot, when possible, also helps to build receptivity and responsiveness of where the body is in space.

Many studies also show that yoga can help to address conditions such as high blood pressure, anxiety, and depression—conditions for which prescription drugs that can cause drowsiness and destabilize balance and motor control are often prescribed to older folks and then contribute to falls and fractures.[6,7]

Vertebral compression fractures are also common. They can occur from extreme, sudden flexion or uneven torsion on the vertebral bodies, but they can also occur over time with fragile vertebrae contending with the gravitational effects of poor postural alignment, particularly with a hyperkyphotic thoracic curve and forward-head position.

Exercise specialists endorse very conservative movement instructions of the spine based on the most fragile cases of osteoporosis. The common recommendation for everyone—regardless of their fracture risk—is to bypass the movement of the spine altogether by "hinging at the hip" and avoiding all twists. This instruction produces a lot of fear about how to go about daily activities, let alone exercise. It also generates a lot of confusion over how the spine works in conjunction with the rest of the body.

The authors of the 2013 *International Journal of Yoga Therapy* article "Yoga, Vertebral Fractures, and Osteoporosis: Research and Recommendations" pinpoint the negative effects of this reductive stance, stating that "inactivity and lack of movement of the spine can contribute to the risk of fracture vis-a-vis muscle weakness, lack of spinal mobility, and compromised balance." The authors note that "people with lower degrees of fracture risk may be adversely served by recommendations to avoid movement[s] of the spine (including axial rotation) that are a part of daily living."[8]

Although extreme cases of bone fragility do exist, the majority of people need not move as if they have a rod in their spine. Recognizing that twists and forward bends are common in many activities of daily living (ADL), BoneFit, an evidence-informed exercise training program offered by Osteoporosis Canada and the Bone Health & Osteoporosis Foundation, promotes revised guidelines that qualify these movements. They say to limit (but not altogether avoid or banish) "repeated, sustained, weighted, end-range, rapid, forceful, or combined flexion, rotation, side bending, and combinations." The program also recommends reducing "the cumulative effect of flexion, slouching, rotation in ADLs and work ergonomics." A study on flexion versus extension that showed greater risk of fractures with flexion exercises is often cited as the reason to avoid flexion altogether.[9] But the flexion exercises in the 40-year-old study included repeated, rapid, and forcible compression of the upper spine with old-fashioned situps.

Resources for Yoga Therapists and Clients

Books

- *Dr. Lani's No-Nonsense Bone Health Guide: The Truth About Density Testing, Osteoporosis Drugs and Building Bone Quality at Any Age* by Lani Simpson, DC, CCD
- *Great Bones: Taking Control of Your Osteoporosis* by R. Keith McCormick, DC
- *Yoga for Osteoporosis: The Complete Guide* by Loren Fishman, MD, and Ellen Saltonstall

Websites

- American Bone Health—https://americanbonehealth.org/
- Bone Health & Osteoporosis Foundation—www.bonehealthandosteoporosis.org
- Japanese Osteoporosis Foundation—www.jpof.or.jp/
- Osteoporosis Canada—https://osteoporosis.ca
- United States Bone and Joint Initiative—https://usbji.org
- Royal Osteoporosis Society—https://theros.org.uk/

Yoga therapy can take a more careful and informed approach. Forward bends and twists can be done slowly with the breath, employing the supportive, gentle bracing that comes with exhalation. Emphasizing the support of the breath highlights how the thoracic and abdominal cavities support the front of the spine and teaches interoceptive awareness so clients can take the movement patterns off the mat and into safe ADLs.

Back extension exercises particularly help with postural support. Lifting the sternum and broadening across the chest while strengthening spinal muscles counters excessive kyphosis in the upper spine. Severe kyphosis can not only lead to vertebral compression fractures but can also contribute to balance issues and loss of lung capacity.

The benefits the bones receive from the breath cannot be underestimated. From a blood pH perspective, engaging in slow deep breathing through the nose balances the effects of a common overbreathing state (typically through the mouth) and helps to minimize mineral-depleting buffering.[10]

From a yogic perspective, we know that all materiality evolves and changes throughout our lifespan. Nevertheless, when clients receive a diagnosis of osteoporosis, they are often fearful and feel fragile. They may be confused about the right course of action to take given conflicting medical advice on treatment, random internet recommendations, and the imprecision of the diagnostic tools. Stress contributes to many health problems, including osteoporosis. Providing any type of stress-relieving practice for a client upregulates the parasympathetic nervous system and increases vagal tone.[11,12] Aside from the metabolic benefits, in this "rest and digest" state we are more likely to take care in the food we eat and our digestive systems are better supported to absorb the nutrients our bones need. Strengthening our digestion overall improves both our physical and our emotional health; yoga and nutrition can go hand in hand to nourish our bones.[11,12] Also, with less stress and anxiety clients are often able to sleep better, which is when our bodies perform cellular maintenance on all of our organs and tissues, including bones.

Putting It All Together

The broader spectrum of yoga tools and the models that yoga employs to understand the body are not as well known in the general public, but we yoga teachers and therapists can use these tools to get a deeper understanding of our bones and their relationship to the whole body. By restoring balance to the whole system, we can have the most impact in supporting clients with osteoporosis or low bone density. And, by bringing to the forefront the value of building up and maintaining our bones over a lifetime, hopefully we can even make a difference for other clients so that they do not receive this diagnosis in the future. Our bones are vital organs and an integral part of our interconnected human system and merit specific care. ●

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